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American Foundryman

A PUBLICATION PRESENTING ASSOCIATION AND CHAPTER ACTIVITIES

Scrap—the Stuff that Brings Victory, See Page 6 (Courtesy Hamilton Foundry & Machine Co.)

Mold and Core Surface Behavior at Pouring Temperatures, See Page 2. New Government Scrap Drive, See Page 6. Maintaining Balanced Composition in Nonferrous Alloys, See Page 7. Magnesium Alloy Castings Practice, Page 13.

October 1943

Advancement of the Industry Follows Progress of Individuals

IT IS a recognized fact that the foundry as a whole has progressed more in the past fifteen years than it did in the previous seventy-five. This progress has been brought about by increased knowledge and development of the metals, processes and equipment involved. Because of this, the foundry industry today is making products which a few years ago were thought to be impossible of manufacture by the casting process. At the same time, quality of product has improved consistently.

Knowledge, in itself, is useless unless applied, and foundries are applying the knowledge that has been accumulated for the technical control of their manufacturing processes, which means improvement of quality and reproducibility of results. Such control usually rests in the hands of the trained engineer, metallurgist and chemist. However, technical control in the foundry industry is not as widespread as it should be. Those plants which employ trained control staffs realize the economic value of such departments.

Technical control cannot be installed overnight. It is a gradual process, and it is doubtful if any foundry operates under 100 per cent control. In the beginning of a control program, opposition often develops. One of the fundamental means by which such opposition can be avoided is by selling the supervisory force on the value—in fact, the necessity—of improving or maintaining product quality.

As the manager of a company engaged in extensive foundry operations, it is my belief that men who are familiar with the practical advancements of the industry as well as those of a technical nature (especially those that affect the operations with which the individual supervisor is charged) are more readily amendable to the introduction and continuance of technical control. One of the methods by which supervisors and potential supervisors may be schooled to think in terms of producing the highest possible quality in the greatest possible quantity, day in and day out, is through use of information obtained by membership in the technical organization of their industry.

The American Foundrymen's Association, with its broad interests, is the technical and educational organization of the foundry industry, and the one from which management may expect its supervisors and potential supervisors to receive not only information of use in their daily tasks, but inspiration and a sense of pride in the organization and industry in which they work.

My long connection with the industry and the Association has convinced me that if both the management and members of the operating supervisory force in all foundries were more aware of and more interested in the technical and practical advancement of their individual plants, the industry, both individually and collectively, would make great strides in the application of its products, coupled with general improvement in quality, in a measure heretofore undreamed of.

Such strides cannot be made overnight. Industry education and interest is required. The American Foundrymen's Association can supply the educational material. *You* must supply the interest.

Max Kuniansky

MAX KUNIANSKY, *Director*
American Foundrymen's Association.

American Foundryman

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Time available for reading is limited for many men in the industry. The desire and need for technical information concerning materials that one works with is greater than ever. It thus seems opportune to present up-to-date information on the behavior of mold and core surfaces at metal pouring temperatures in the form of an outline, classified according to properties as determined with a dilatometer.

Charts Data on Mold and Core Surface Behavior at Pouring Temperatures

By H. W. Dietert
President, Harry W. Dietert Co., Detroit

SPALLING

A. RESULT OF:

1. Unequal volume change of the sand or core sectional areas or layers.
2. Low ductility of sand or core surface, which is unable to accommodate the hot expansion or hot shrinkage.

   (NOTE: Certain sands which possess high ductility, or high hot deformation, will not spall when high expansion is present.)
3. Large difference in hardness of adjacent sectional areas or layers, causing great differences of volume change between the two areas.
4. Large difference in the rate of heating of two adjacent sectional areas.

   (NOTE: Well demonstrated by a poorly dried dense mold or core surface. The dense surface heats up rapidly and expands. The damp layer of sand or core underneath the dense surface heats up slowly, resulting in a great difference in temperature, or unequal growth.)
5. Lack of void spaces between the sand grains to allow for the growth of the sand grains.
6. Lack of refractoriness, resulting in a high volume change due to a high hot shrinkage.

B. REDUCED BY:

1. Arranging to secure equal volume change of adjacent sectional areas or layers of sand, by means of:
   (a) Possessing sufficient hot permeability.
   (b) Obtaining equal heat input into the mold by spreading ingates.
   (c) Obtaining equal hot deformation.
   (d) Obtaining equal controlled hot strength by proper selection of ingredients.
   (e) Obtaining controlled hardness.
2. Obtaining a surface possessing a conservative hot deformation, avoiding lack of ductility.
3. Using a molding material that possesses sufficient void spaces at elevated temperatures.

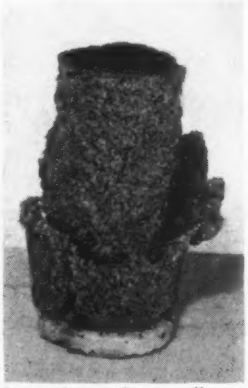


Fig. 1—A sand specimen that spalls at metal pouring temperatures.

C. DEFECTS *(See Fig. 1):*
(Same as "C" under *Volume Change.)*

D. REMEDY:
(Same as "D," under *Volume Change.)*

HOT DEFORMATION

A. RESULT OF:

1. Formation of a limited quantity of viscous glasses, liquids or semi-plastic materials at elevated temperature from the binders and other ingredients present in the sand or core.

B. REDUCED BY:

1. Selection of binders possessing low hot deformation.

C. DEFECTS AND REMEDY:

1. Cuts and washes. *(See Fig. 5)* *(Remedy:)* Increase hot deformation, as shown under "B."

VOLUME CHANGE

A. RESULT OF:

1. Hot expansion of sand grains.
2. Hot shrinkage of fine materials, such as fluxes and bonds.

B. REDUCED BY:

1. Creating greater void spaces between sand grains, by means of:
   (a) Addition of combustible materials such as cereal binders, sea coal, pitch, straw, wood flour.
   (b) Reduction of flowability, through:
      1. Addition of coarse sand grains.
      2. Increase in clay content.
      3. Increase in green strength.
      4. Increase in green deformation.
   (c) Reduction of ramming, if permissible.
2. Use of special low expanding grains; for example, sillimanite grains.

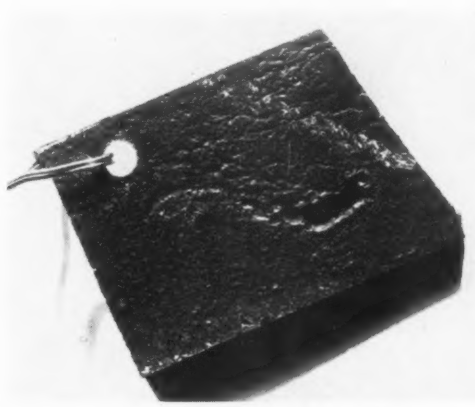


Fig. 2—Casting defect, commonly called a "Seam," caused by spalling of the cope surface of a mold.

C. DEFECTS:

1. Rat tails. *(See Fig. 3)*
2. Buckles. *(See Fig. 4)*
3. Seams. *(See Fig. 2)*

D. REMEDY:

Reduce expansion and spalling, as shown under "B."

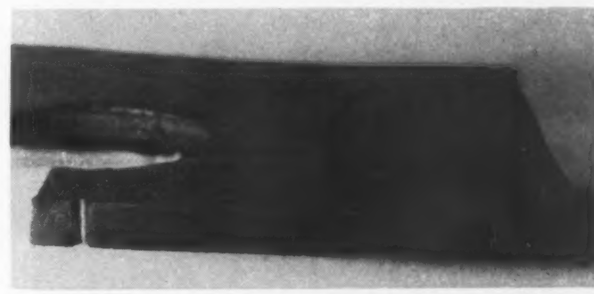


Fig. 3—Casting defect, termed "Rat Tail," caused by high expansion spalling of the mold wall.

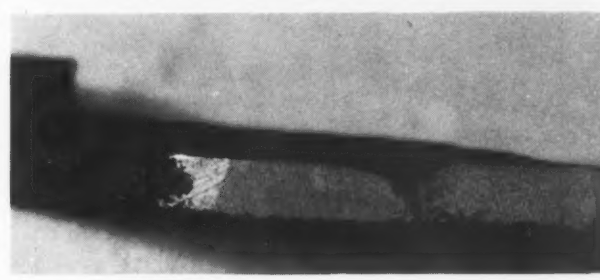


Fig. 4—Buckle casting defect due to spalling, the result of high expansion of the facing sand.

HEAT CONDUCTIVITY

A. RESULT OF:

1. Heat transfer by the hot air and gases traveling from the mold or core face surfaces to other section of the mold or core. Classed as heat transfer by convection.
2. Heat transfer by heat travel from sand grain to sand grain. Classed as heat transfer by conduction.

B. REDUCED BY:

1. Reduction of hot permeability of the molding material.
2. Choosing molding materials of low heat conductivity as measured by conduction.
3. Increasing the moisture content of the molding material.
4. Additional research work must yet be done on this subject to reveal a method of controlling heat conductivity.

C. DEFECTS:

(Casting defects charged to Heat Conductivity are yet to be defined.)

GLAZING

A. RESULT OF:

1. Formation of glasses at the surface of the mold or core at elevated temperatures.
2. Inclusion of fluxing ingredients in the sand or core.

B. REDUCED BY:

1. Using molding materials possessing high refractoriness.
2. Increasing sintering point B of molding materials.

C. DEFECTS AND REMEDY:

1. Penetration.
   (Remedy:) Lack of a glazed surface may contribute to metal penetration.

HOT STRENGTH

A. RESULT OF:

1. Development of a pyro-strength of binders such as clays, bentonite or silica flour.
2. Composition change of the binder to some stable ceramic material at elevated temperatures.
3. Melting of one or more materials to form a viscous liquid at elevated temperatures.

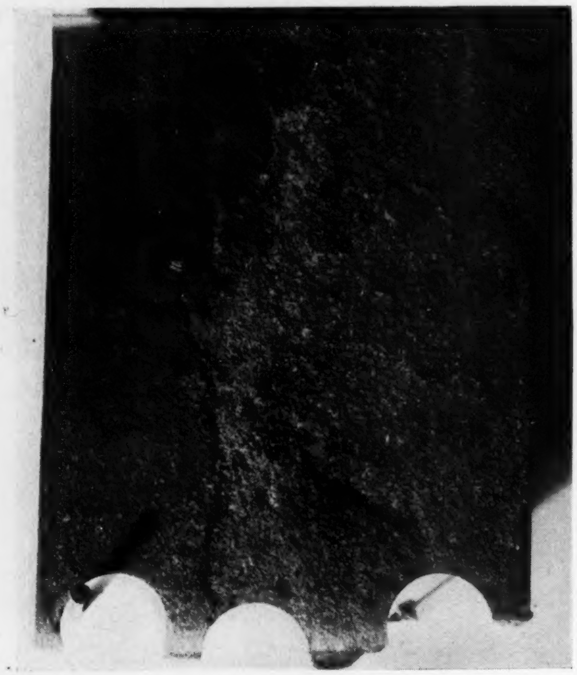


Fig. 5—A cut or wash casting defect, caused by a low hot strength.

B. REDUCED BY:

1. Increasing grain size of molding material.
2. Reducing ramming, when permissible.
3. Reducing moisture, when permissible.
4. Reducing silica flour additions.
5. Selection binders that are combustible.
6. Selecting binders that possess low hot strength.

   (NOTE: The order of hot strength at elevated temperature from low to high hot strength is substantially as follows: bran, cereal binder, wood flour, resins, oil, sea coal, pitch, iron oxide southern bentonites, northern bentonites, clays, combination of northern bentonite and certain clays, fine sand, and silica flour. The latter possesses the power to increase hot strength to very high values.)

C. DEFECTS AND REMEDY:

1. Hot tears or cracks. *(See Fig. 9)* *(Remedy:)* Lower hot strength, as shown under "B."
2. Cuts and washes. *(See Fig. 5)* *(Remedy:)* Increase hot strength, as shown under "B."

   (NOTE: Hot deformation must also be considered. Low hot deformation enhances cuts and washes.)
3. Penetration. *(See Fig. 8)* *(Remedy:)* Try increasing hot strength or glazing, as shown in "B" above, also under Glazing, "B."

COLLAPSIBILITY

A. RESULT OF:

1. Oxidation of binders present in mold or core surface by high temperature.
2. Composition change of the binder to a non-binding material on being subjected to elevated temperature.

Fig. 6—Fin or fissure casting defect on core surface, caused by too early collapse of the core surface.

B. RETARDED BY:

1. Increasing hot strength.
2. Decreasing grain size.
3. Increasing silica flour.

(Continued on next page)

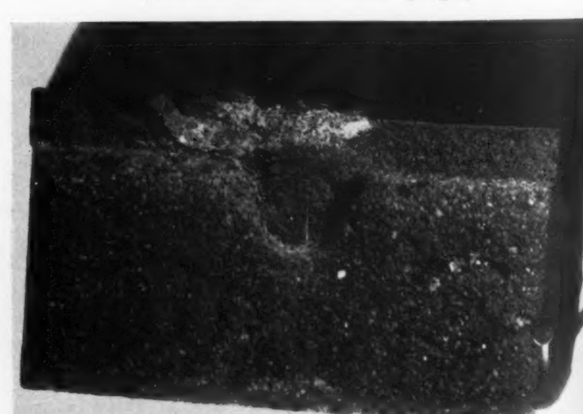


Fig. 7—Scab casting defect, the result of high hot shrinkage, caused by high expansion and large contraction at elevated temperature.

4. Addition of iron oxide to clay-free or low-clay content core mixtures.
5. Reduction of combustible binders.

C. DEFECTS AND REMEDY:

1. Fins or fissures. *(See Fig. 6)* *(Remedy:)* Retard collapsibility, as shown under "B."
2. Penetration, in certain cases. *(See Fig. 8)* *(Remedy:)* Retard collapsibility.
3. Scab. *(See Fig. 7)* *(Remedy:)* Retard hot shrinkage by increasing refractoriness or sintering of molding material.
4. Hot tears or cracks. *(See Fig. 9)* *(Remedy:)* Hasten collapsibility, as shown under "B."
5. Long castings coming to greater length than desired, in certain cases. *(Remedy:)* Hasten collapsibility, as shown under "B."

Fig. 8—Penetration casting defect, the result of the too rapid collapse of a core.

Fig. 9—A hot tear casting defect, caused by a high hot strength, resulting in a slow collapsing core.

HOT PERMEABILITY

A. RESULT OF:

1. Maintaining open connected pore spaces through the sand or core at elevated temperatures.
2. The quantity of gas generated at elevated temperature that must be vented through the pore spaces, in addition to mold cavity gases that must be vented.

B. REDUCED BY:

1. Reduction in grain size of material.
2. Research work is in progress determining factors affecting hot permeability of both sands and cores.

C. DEFECTS:

(Casting defects charged to Hot Permeability are yet to be defined.)

Appoints Non-Ferrous Advisory Committee

EXECUTIVES of 14 foundries have been invited to form a Non-Ferrous Advisory Committee to consult with the OPA on pricing of non-ferrous products. Members include:

L. E. Degroat, Permold Co., Medina, Ohio; Chester K. Faunt, Christensen & Olsen Foundry Co., Chicago; William D. Goldsmith, C. A. Goldsmith Co., Newark, N. J.; A. G. Harter, Quality Aluminum Castings Co., Waukesha, Wis.; E. H. Holzworth, Frontier Bronze Corp., Niagara Falls, N. Y.; E. W. Horlebein, Gibson & Kirk Co., Baltimore, Md.; William Kelley, Springfield Brass Co., Springfield, Ohio; F. A. Mainzer, Pacific Brass Foundry of San Francisco, San Francisco; F. H. McCullough, Springfield Bronze & Aluminum Co., Springfield, Mass.; D. W. Moll, Hills-McCanna Co., Chicago; James J. Nelson, Cramp Brass & Iron Foundries Division, Baldwin Locomotive Works, Philadelphia; T. W. Pettus, National Bearing Metals Corp., St. Louis; Charles Wegelin, Dixie Bronze Co., Birmingham, Ala.; and F. S. Wellman, Wellman Bronze & Aluminum Co., Cleveland.

Production Awards for Two More Foundries

RECOGNITION for outstanding war production work was earned by the employees of the Reading-Pratt & Cady Division and the Reading Steel Casting Division, American Chain & Cable Co., Inc.,

Reading, Pa., when the Maritime "M" award was presented to the company on July 16. Lee C. Wilson, general manager of the Reading Steel Casting Division, is now serving as president of the American Foundrymen's Association.

WPB Seeks 15,000,000 Tons of Metal in Big Scrap Drive

ONCE again Government agencies are preparing to launch a nationwide campaign to collect iron and steel scrap. There is growing concern over inadequate supplies of these metals for the fall and winter months, for it is during that period that collections usually decrease.

The Salvage Division of the WPB revealed that the collection goal for the last half of 1943 is 15,000,000 net tons, with industrial salvage expected to yield 9,800,000 tons of the total. This means that the shelves in the storerooms of America, whether in the home or in the workship, will have to be cleared of any metal that can be sacrificed.

A Scrap "Yardstick"

While individual judgment will have to dictate the extent to which idle materials and equipment can be spared, the scrap "yardstick," developed by the National Association of Manufacturers in cooperation with the WPB, can generally be applied—"If it has not been used for three months, and if it will not be used for the next three months, *Scrap It!*"

The sources of idle metal are too numerous to mention, but nothing is too insignificant to donate to the scrap piles that will be converted into the ships, tanks, planes and guns that will defend the cause of freedom.

Today, each individual American soldier requires an average of 4,900 pounds of steel, in the form of carried or supporting equipment. In World War I, he needed only 90 pounds!

More Steel Production

Project this figure to include an army of ten to thirteen million men. Add to it the astronomical tonnages of steel blown to bits as explosives — there is no scrap recovered from this! Then, take into account the steel being used to produce military cargo, etc., at our present rate of production, and couple that metal demand with the supply required for the expansion of war plants, shipyards and factories.

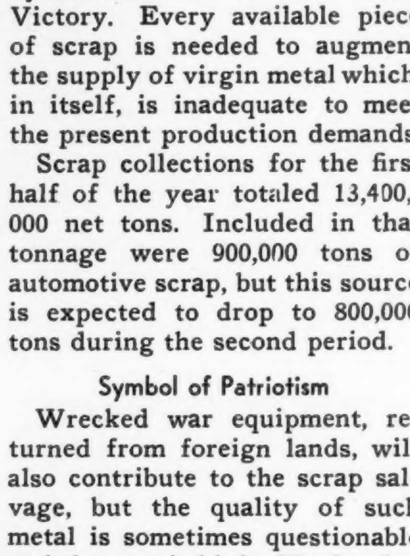
Taking all this into consideration, it is easy to appreciate that the 1942 record of 90,000,000 tons of steel making must be lifted by millions of tons to clinch Victory. Every available piece of scrap is needed to augment the supply of virgin metal which, in itself, is inadequate to meet the present production demands.

Scrap collections for the first half of the year totaled 13,400,000 net tons. Included in that tonnage were 900,000 tons of automotive scrap, but this source is expected to drop to 800,000 tons during the second period.

Symbol of Patriotism

Wrecked war equipment, returned from foreign lands, will also contribute to the scrap salvage, but the quality of such metal is sometimes questionable and the cost is high. The burden of collection rests squarely upon the home sources of supply.

THE SOWER NEEDS MORE



Therefore, let every foundry inaugurate its private scrap salvage drive, examining every possible hiding place for idle material, so that the campaign will have the full support of an industry that is in a position to contribute a lion's share to the undertaking.

Gather together those rusting, broken, idle pieces of iron and steel. Add them to the Victory Scrap Banks in the foundry yards of America, for those mountains of salvaged metal are as symbolic of patriotic effort as any production award banner blowing from a company flag pole!

Metal Spray Used to Increase Pattern Life

METAL spraying of wood patterns is a development which has been made use of by a number of pattern companies to solve the shortage of critical materials in pattern making. According to this process, wood patterns are sprayed with metal, and such patterns are said to stand up well under rough usage.

In applying the sprayed metal, wood of the pattern is roughened slightly, and a small deposit of zinc is applied so that the wood is not charred when the metal is sprayed upon it. Following the zinc coating, metal of any desired composition may be sprayed upon the wood pattern.

The metal coating is said to adhere strongly to the wood and to give a finish which will withstand sand abrasion in the mold, thus giving considerably longer life to the pattern than if it was made of wood. It is said that patterns prepared in this manner compare favorably with the metal pattern equipment.

An interesting account of the development of cast iron pressure pipe manufacture in this country is contained in a 102-page booklet by Henry J. Noble, American Cast Iron Pipe Co., Birmingham, Ala., entitled "History of the Cast Iron Pressure Pipe Industry in the United States," published by The Newcomen Society.

This article emphasizes the importance of adding zinc in melting and superheating nonferrous alloys to pouring temperature and the advisability of making up for shortages of tin or zinc in the ingot metal, in order to maintain a balanced composition. It shows that neglect to do so frequently results in a copper content that is 2 or 3 per cent higher than necessary for the castings. For example, the well known 85-5-5-5 is frequently found to run 88 per cent copper, where better physical properties might be obtained with 84 per cent copper, if properly balanced.

Checking and Adjusting Brass Foundry Alloys

By G. M. Thrasher
R. Lavin & Sons, Inc., Chicago

THE importance of keeping a balanced composition in most non-ferrous alloys is little understood and appreciated by many foundrymen, who melt and remelt without correcting additions until the copper content is often too high for the best fluidity and castability.

Specifications which allow the same degree of departure from nominal composition, without regard to the metallurgical effect of each element, are misleading and a snare to the uninitiated.

Considering the copper, tin, lead and zinc alloys, it is well known that the lead is soluble in the copper alloy when all is melted, but when the alloy freezes the lead is left in liquid drops which do not freeze until a temperature of about 619°F. is reached.

From the above consideration, we can see that the lead may be considered as distributed in a matrix of a ternary or 3-element alloy of copper, tin and zinc.

Properties Arranged on Diagonal

By figuring the nominal or desired composition of the well known pressure and general purpose alloys to the lead free basis, as listed in Table 1 and plotting the results on the triangular diagram, as shown in Fig 2, we find that the leaded bronzes and brasses of good foundry properties arrange themselves along a diagonal line extending from 7 per cent tin to 21 per cent zinc. Therefore, as an alloying element, zinc is only one-third as effective as tin.

This line is the approximate dividing line between the all alpha or solid solution alloys, to the left and above, and the alpha plus delta alloys, which occur when the composition falls below, or to the right. For the best pressure resistance and good casting qualities, there should be just a little of the delta tin crystals present, constituting a saturated condition of the alpha. The importance of this is most noticeable in those pressure castings which have the outer skin removed by machining.

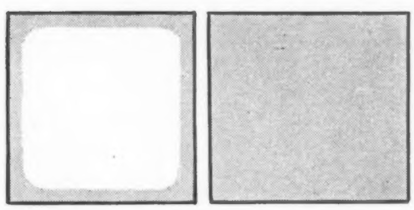


Fig. 1—Fracturing a square test bar is helpful in indicating pressure tightness and density. (Left) A picture frame fracture with golden center is deficient in zinc for the amount of tin present. (Right) Best fracture, without inner golden color; fracture even gray and fine grained.

The Simplified Diagram (Fig. 3) obviates the necessity of figuring to the lead free basis, as shown in the following examples:

Alloy "C" with approximately 5 per cent lead, requires Tin plus 1/3 Zinc—6.7 to 6.9 per cent.

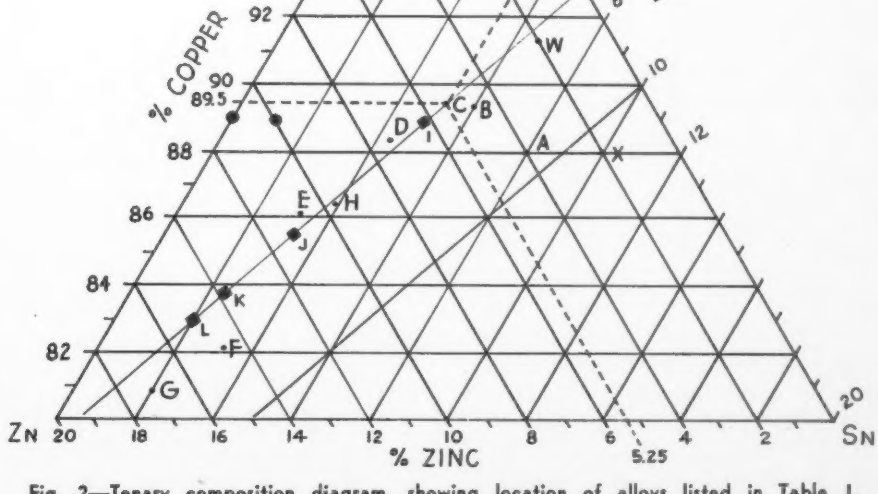


Fig. 2—Tenary composition diagram, showing location of alloys listed in Table 1, figured to lead free basis.

Alloy "H" with approximately 8.5 per cent lead, requires Tin plus 1/3 Zinc—6.5 to 6.7 per cent.

The compositions shown in Table 1 are commonly used as pressure resisting and general casting alloys in the brass foundries. When these are figured to the lead free basis, all conform approximately to the formula: Tin plus one-third of Zinc equals 7.0. For pressure resistance best results are when this figure is 7. to 7.4.

All of these alloys lose about 10 per cent of the zinc contents in melting and superheating to pouring temperature, and in some open flame furnaces about one-third of the zinc is lost. To keep the alloy in good working condition, this zinc loss should be made up by the addition of zinc to each melt. The loss occurs whether you melt all ingot or all sprues, as some of the zinc becomes a vapor when heated above 1665°F. Superheating to higher pouring temperature causes increasing loss.

While the normal zinc loss in one melting of alloy "C" is about 0.50 per cent of the melt, or half a lb. per hundred, the ingot metal furnished may be somewhat lower in tin and zinc than the desired composition.

Experience has shown that, with tin at 4.75 per cent and zinc at 5.75 per cent or 6.0 per cent, the foregoing alloy will have equally good physical properties, and it may be desirable to add one lb. per hundred of ingot plus half a lb. per hundred of sprues.

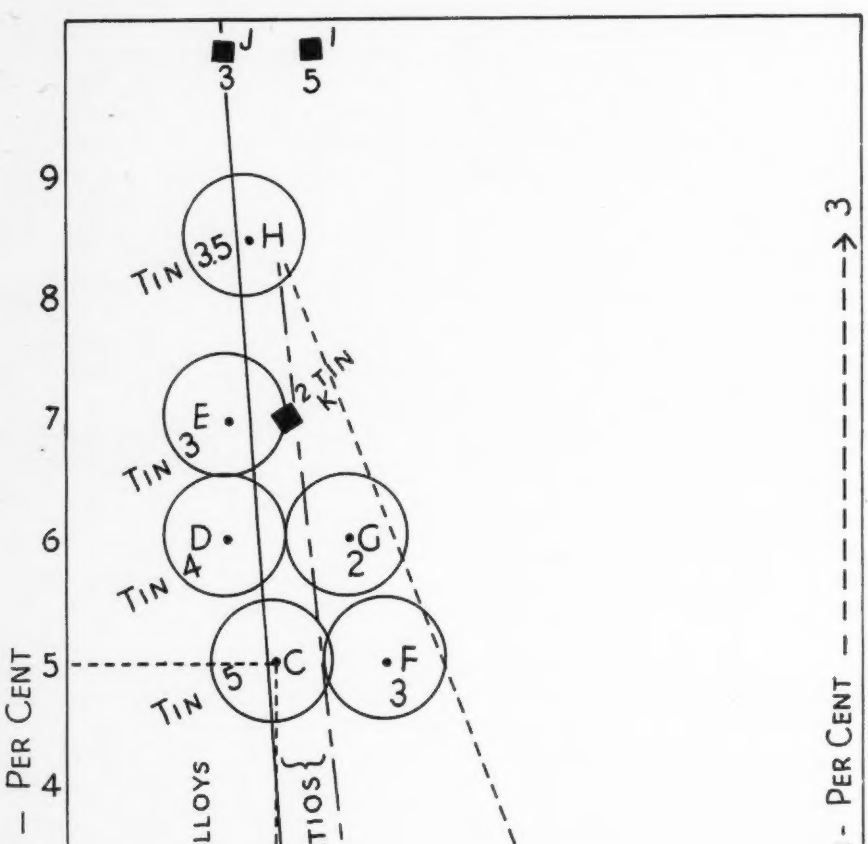


Fig. 3—Simplified diagram to simplify calculation of balance on Copper-Tin-Zinc-Lead alloys for pressure castings.

Fractured Specimens Indicate Condition

As a large number of brass foundries do not have chemical control, it is fortunate that a study of fractured specimen castings gives a clue to proper condition.

If we cast a square test bar (Fig. 1) about ¾x¾x5 in., nick it ⅛ in. deep with a hacksaw and break it, we have a fracture which is quite helpful in indicating best pressure tightness and density in these leaded brass and bronze castings.

When lead is below 2 per cent the results are more difficult to interpret. The dotted lines on Figs. 2 and 3 indicate how alloy "C" is plotted.

When analysis is not available the following figures may be used:

Navy "G"—add ½ lb. zinc per 100 lb.

Navy "M"—add ½ lb. zinc per 100 lb.

85-5-5-5—add one lb. zinc per 100 lb.

Manganese Bronze—add 3 or 4 lb. zinc per 100 lb.

When melted in open flame furnaces, the requirements may be double the above.

Manganese bronze may be checked by pouring a bar ¾x⅜ x8 in. in a small chill mold, such as used for solder. Hold the lip of the ladle close to the end of the mold in order to produce a smooth top ingot.

Testing of Properties

To test, do not nick it; rather, secure the rougher end in a heavy vise, slip a piece of pipe over the bar and bend until it breaks. The outside of the bend should be the bottom of the bar.

The best physicals are obtained if the bar breaks with a

TABLE I

Bronze and Brass Compositions

	Nominal Composition				Lead Free Basis			
	Cu. Pct.	Sn. Pct.	Zn. Pct.	Pb. Pct.	Cu. Pct.	Sn. Pct.	Zn. Pct.	Reference
W	90.0	6.5	2.0	1.5	91.4	6.6	2.03	A.S.M.E. Recommended substitute for 88-10-2 in 1917-18.
B	88.0	6.0	4.5	1.5	89.3	6.1	4.6	Cast Metals Hand Book—Table 59, No. 1. Navy 46B8g.
C	85.0	5.0	5.0	5.0	89.5	5.25	5.25	Cast Metals Hand Book—Table 59, No. 1. Navy 46B23c.
D	83.0	4.0	7.0	6.0	88.3	4.26	7.45	Cast Metals Hand Book—Table 61, No. 1.
I♦	(2 Ni) 77.0	5.0	6.0	10.0	87.8	5.55	6.65	Cast Metals Hand Book—Table 59, No. 3.
H	79.0	3.5	9.0	8.5	86.3	3.83	9.84	(Author's experience)
E	80.0	3.0	10.0	7.0	86.0	3.23	10.75	Cast Metals Hand Book—Table 61, No. 2.
J♦	77.0	3.0	10.0	10.0	85.6	3.33	11.1	Cast Metals Hand Book—Table 61, No. 3.
K♦	78.0	2.0	13.0	7.0	83.9	2.15	13.95	Cast Metals Hand Book—Table 61, No. 4.
F	78.0	3.0	14.0	5.0	82.1	3.16	14.75	A.S.T.M. Specfn.—B30-36, No. 10.
L♠	81.0	2.0	15.0	2.0	82.65	2.04	15.3	Color match for extruded metal.
G	76.0	2.0	16.0	6.0	80.9	2.13	17.0	A.S.T.M. Specfn.—B30-28, No. 5.

NOTE: Other purpose alloys such as "G" bronze, which is extensively used for heavy castings and pumps, sometimes require heat treatment.

A	88.0	8.0	4.0	Max. 0.20	88.0	8.0	4.0	"G" Bronze—High Strength, Replace 88-10-2. Navy 46M6g.
•	83.25	0.0	10.5	6.25	88.8	9.9	11.2	Very Ductile—Small disc rings.
•	84.5	1.2	9.5	4.8	88.76	1.26	9.98	Harder—Larger disc rings.
	88.0	4.0	6.0	2.0	....	......	....	Special hardware, requires bending.

NOTE: The last three alloys are used where castings require cold work after cast either by peening, rolling or bending.

fine grain, like tool steel, when bent to about 30° from straight.

If it bends double, it will have a coarse grain, much lower tensile strength, higher elongation and the zinc will have been about 2 per cent to 3 per cent too low with correspondingly higher percentages in copper.

Jim Allan Honored by Industrial Commission

JOS. R. ALLAN, assistant manager, Industrial Engineering and Construction department, International Harvester Co., Chicago, has been appointed a member, representing industry, of the Advisory Committee of the Health and Safety Commission of the State of Illinois, by Alfred J. Borah, chairman of the Illinois Industrial Commission.

O. E. Mount, American Steel Foundries, Chicago, is chairman of the Employers' Section of the same Advisory Committee.

The foundry industry is fortunate to have two such excellent representatives on the Illinois Industrial Commission. Both Messrs. Allan and Mount have long been active in its work, and their appointments should provide the foundry industry with representation which understands completely its problems.

Mr. Allan has been especially active in safety and hygiene work on behalf of the foundry industry, and for his efforts he was awarded the J. H. Whiting Gold Medal of A.F.A. at the 1939 convention. He is well known to the industry especially for his work as chairman of the A.F.A. Industrial Hygiene Codes Committee.

Plan Shrinkage Study of Brass and Bronze

THE Research Committee of the Brass and Bronze Division of A.F.A. is undertaking research work in connection with the shrinkage of copper base alloys. The committee is composed of G. P. Halliwell, H. Kramer & Co., Chicago; N. A. Ziegler, Crane Co., Chicago; W. W. Edens, Ampco Metal, Inc., Milwaukee; and A. K. Higgins, Allis Chalmers Mfg. Co., Milwaukee.

Ed Westover Joins the Grede Foundries

C. EDWARD WESTOVER, formerly Executive Vice-President of the American Foundrymen's Association, has joined the staff of Grede Foundries, Inc., Milwaukee, it has been announced by W. J. Grede, President.

C. E. Westover

Mr. Westover's new duties take him back into the foundry business on the executive staff, with special engineering and administrative responsibilities. He started his employment on September 1, and is now comfortably located in a new home at 2434 N. Terrace Ave., Milwaukee.

Ed's many friends will wish him success in his new activities.

"Choosing Women for War Industry Jobs," is the title of Special Bulletin No. 12, issued by the Women's Department of the U. S. Department of Labor, Washington, D. C., recommending methods for developing a good program for the use of womanpower in war production industries. An extensive bibliography on the subject is appended.

Plant Personnel Problems Aided by Job Relations Training Plan

THE Job Relations Training program, the third program offered war industries by the Training Within Industry division of the War Manpower Commission, now is being conducted in plants throughout the country. First demonstrated to the foundrymen as a group at the 1943 Foundry Congress in St. Louis, the program has since been adopted by a number of foundries as a part of their supervisory training work.

Many foundries previously have given their supervisors an effective start in developing individual skills in instructing through use of the Job Instructor Training program of T.W.I. Of these firms, a large number have continued this work with Job Methods Training, designed to help foremen, lead men and group leaders work out improved methods of performing all kinds of small jobs.

The Job Relations Training program presents a practical way to help supervisors develop skill in getting results through those they supervise. It helps them improve their understanding of individual employees, their ability to size up personnel situations, and their methods of dealing with people in the plant.

Like the other training programs offered by T.W.I., Job Relations Training is a streamlined, standardized plan that applies to any industry, anywhere, regardless of its size. It is conducted right at the plant to groups of 10 or 12 supervisors at a time, in five sessions of two hours each. Obviously, in that time it can present only a basic pattern for improving relations between employees and management, but it is conducted on a practical rather than theoretical basis by industrially trained men.

How the program is conducted and some of the results it has accomplished in various plants was well portrayed in an article by Stuart Chase in the September 1943 *Readers Digest*. The personnel manager of one plant which carried the program early this year has since noted a 50 per cent decrease in personnel grievances appealed beyond the immediate supervisor.

An overflow crowd of foundry and other plant executives in the Chicago area attended a factual demonstration of the training program July 29 at Hotel La Salle, Chicago, at a meeting sponsored by the Illinois Manufacturers' Association. Since then, A.F.A. has recommended Job Relations Training to its company members and a number of A.F.A. Chapters have indicated interest in having the program demonstrated before their meetings.

Because all three programs have wide application in the foundry industry, it is hoped that a number of chapters will follow suit. Those desiring further information should communicate direct with local offices of Training Within Industry division, located in 22 major cities throughout the country.

A.S.T.M. Issues New Alternate Provisions

IN ACCORDANCE with a special procedure, in the interest of expediting procurement or conservation of materials during the present national emergency, the American Society for Testing Materials has issued alternate provisions to standard specifications for aluminum-base alloy die castings (B85-42), shown in Table 1. Only the chemical requirements referred to in the 1942 issue of "A.S.T.M. Standards" are affected.

Emergency alternate provisions were also released for standard specifications for alloy-steel castings for structural purposes (A148-42), with only the physical property requirements being affected. The changes in-

Table 1

Composition of Aluminum-Base Alloy Die Castings A.S.T.M. Specification EB85-42

	Alloy No. LXXIX-A Casting Alloy for Goose Neck Machine	Alloy No. LXXIX-B Casting Alloy for Cold Chamber Machine
Copper, per cent	3 to 4	3 to 4
Silicon, per cent	4.5 to 9.5	4.5 to 9.5
Nickel, max., per cent	0.5	0.5
Iron, max., per cent	2.0	1.3
Zinc, max., per cent	1.0	0.6
Manganese, max., per cent	0.5	0.5
Magnesium, max., per cent	0.10	0.10
Other elements, each	0.15	0.15
max. per cent total	0.5	0.5
Aluminum	remainder	remainder

Table 2

Minimum Physical Properties Required Under A.S.T.M. Specification EA148, Alloy Steel Castings for Structural Purposes

	Tensile Strength, min., psi.	Yield Point, min., psi.	Elongation in 2 in., min., per cent	Reduction of Area, min., per cent
Class A:		REGULAR GRADES		
Grade 1	75,000	40,000	24	35
Grade 2	85,000	53,000	22	35
Class EB:		EMERGENCY GRADES		
Grade 3	100,000	65,000	17	30
Grade 4	105,000	85,000	15	30
Class EC:				
Grade 2	120,000	100,000	12	25
Grade 3	150,000	125,000	10	20

NOTE—The six grades listed above are considered applicable during the war emergency period. Two of the six grades are regular grades with no change in requirements, while the other four are emergency grades with modifications intended to expedite production.

These alternates are intended for use where the purchaser of a specific material considers them suitable and permissible for a certain application.

clude the former Class B castings, now Class EB, which may be normalized, or normalized and tempered or drawn. Previously the heat treatment recommended for this class of casting was full annealing and normalizing, with quenching and drawing optional.

Class C castings, now Class EC., of three grades, may be heat treated by liquid quenching and tempering or drawing to conform to minimum physical properties, as noted in Table 2.

Chapter War Problems Groups Giving Valuable War Service

MANY pressing war production problems have been aided by the War Problems Committees of A.F.A. Chapters during the past year, although in most cases the information sought and provided is held confidential and not available for publication. Recently, however, two examples of how these local groups, serving without remuneration, have materially helped foundries have come to A.F.A. headquarters.

In the following condensed "case histories," the problems were sent in to A.F.A. by two foundries and promptly referred to the War Problems Committee of the Western New York Chapter, which happened to be the chapter located nearest the questioner. Both problems involved urgent production of war materials.

Problem No. 1

Question—Unable to remove sand adhering to port holes of steam engine gray iron cylinder castings, weighing approximately 225 lbs. each, alloyed with nickel and chromium. Castings cleaned by grit blast. Could difficulty be overcome by dipping castings in an acid bath?

Suggested Remedy—Unless penetration is only mild, it is not practical to remove the sand with an acid bath. Use of proper core mixture and the application of blacking should eliminate the trouble. Penetration resistant core mixture should be used (two suggested mixtures given), but only on the areas subject to penetration, with a good wash on the barrel. Areas affected must have a relatively heavy coat of blacking. If design of the ports is such that the core can be wrapped with sheet asbestos, no special core sand is required, provided the cores are properly wrapped.

In this problem, as well as Problem No. 2, the suggested remedies were provided by the Gray Iron Division of the Western New York Chapter's War Problems Committee, of which Wm. S. Miller, Chas. C. Kawin Co., Buffalo, is Chairman. Other members of the Gray Iron Division group are Alex Rankin, Lake Erie Engineering Corp., Kenmore, N. Y., and M. W. Pohlman, Pohlman Foundry Co., Inc., Buffalo.

Problem No. 2

Question—In producing a roll with cast teeth, the teeth are full of dirt and must be ground all over to remove it, the dirt being caused by sand burning when contacting the iron. A solid metal pattern is used, with dry sand, and pattern is removed vertically.

Suggested Remedy—Rough sketch of recommended pouring and gating system offered, using a combination shower gate and head. Cover or gate core must be of strong sand and the holes blackened. A fine oil sand core mixture should be used to produce a quality finish (suggested mixture given), with sufficient green strength so that cores can be handled in a green state. Permeability should be low enough (between 40 and 60) to give the required finish and prevent penetration.

Hard ram core carefully and vent properly. Improved finish and greater resistance to penetration obtainable with addition of small percentage (1 to 2 per cent) fine seacoal in mixture. Too much, however, may cause cold shuts or gas trapped teeth areas. Metal flask should be used to permit baking, and a facing 1 inch thick is satisfactory, backed up with regular core sand. Mold and bake at 450° F. Job must be cast hot, pouring temperature about 2575 to 2625° F.

To date 14 A.F.A. Chapters have set up local War Problems Committees to handle similar problems for foundries within their immediate territories. Personnel of these committees will be found in this issue on page 28.

A.F.A. Member is Oldest Ordnance Worker in U.S.

IN STARTING his 52nd year of employment at the Rock Island Arsenal, September 12th, Herman E. Alex was recognized as the oldest ordnance worker in any government ordnance plant in the United States, in point of service.

Last year when Foreman Alex was retired because he had reached the age limit of 70 years he told Gen. Norman F. Ramsey, aresenal commandant, "I would never have taken the job if I hadn't thought it was going to

How one foundry company combats the problem of absenteeism. Attendance record board at Hamilton Foundry & Machine Co., Hamilton, Ohio, placed at the time clock entrance to No. 2 foundry leaves no doubt in the minds of employees that reduction of absenteeism is the business of everybody in the plant.

Among the latest A.F.A. members to receive the coveted Army-Navy "E" production award are the Belle City Malleable Iron Co. and the Racine Steel Castings Co., both of Racine, Wis. A colorful presentation ceremony marked the occasion, on August 21. Displaying the flag to assembled personnel and guests are Col. John Slezak (left), Deputy District of the Chicago Ordnance Division, Louis LaBelle (center), president of Local 109 union, and C. S. Anderson (right), president of the two companies.

be permanent." The general immediately rehired Mr. Alex.

A native of Davenport, Iowa, he attended local schools and has been connected with industrial plants of that territory all of his life, having first worked with the Davenport Machine & Foundry Co., Davenport, from 1889 to 1892. He then served as molder at the Rock Island Arsenal until 1911, when he was made general foreman, the position he holds at present.

Major General L. H. Campbell, Jr., Chief of Industrial Service, Production, Office of the Chief of Ordnance, Washington, D. C., in addressing the opening meeting of the annual A.F.A. Convention, in Cleveland, recalled the days when he worked with Herman Alex at the arsenal and how the two of them connived to make it possible for Mr. Alex to attend the different meetings.

"We had to twist around in those days, in order to get Herman to the conventions, but I always saw that he went, and he never failed to come back without something new, something in advance of the art, as we knew it at the Arsenal at the time. That is why I feel that you have one of the livest associations I have ever known."

Mr. Alex has always been interested in local foundry association work and in that of the national association. He was a charter member of the Quad City Foundrymen's Association which later became the Quad City Chapter of the A.F.A.

Horlebein Heads Non-Ferrous Advisory Men

THE organization meeting of the Non-Ferrous Foundry Industry Advisory Committee appointed by O.P.A. recently, was held in Washington August 24, with a number of members of the industry attending. E. W. Horlebein, Gibson & Kirk Co., Baltimore, Md., a Director and Past-President of the Chesapeake Chapter of A.F.A., was elected chairman of the advisory body. Mr. Horlebein is a Director and Past-President of the Chesapeake Chapter of A.F.A., and also serves as Vice-Chairman of the A.F.A. Foundry Cost Committee, representing the Non-Ferrous Founders' Society, of which he is Vice-President.

Special Bulletin No. 11, "A Guide to the Prevention of Weight-Lifting Injuries," has been issued by the Div. of Labor Standards, U. S. Department of Labor, Washington, D. C., describing and illustrating standards for reducing work injuries due to handling of materials. Elimination of lifting hazards, of primary importance, involves over-all planning of process and work methods, selection of employees, training, and continuous supervision.

Indication that the foundry industry ranks among the leaders on the home front is found in a recent WPB release, showing that the production of magnesium castings alone has reached a rate three times as great as at the time of the Pearl Harbor attack.

Wanted: Samples of Sands for New Study of Hot Permeability

HARRY W. DIETERT, Harry W. Dietert Co., Detroit, has asked A.F.A. to assist in obtaining samples of molding sands, cores and core or mold washes for a new investigation being undertaken by his company on the application of hot permeability to casting defects. A large number of samples is necessary so as to obtain sufficient data for sound conclusions on the relation of this property to such defects as scabs and metal penetration.

Foundries who provide sample material will be furnished with test data and Mr. Dietert's comments when the investigation is concluded. Two-quart sealed samples of materials used in the foundry are desired, together with a small section of the defect caused, it is felt, by the sand. A general description of the size of casting, method of molding, temperature of metal and general metal specifications also are requested.

Those interested should communicate direct with Mr. Dietert's company, 9330 Roselawn Ave., Detroit, Mich., as all phases of the investigation are being conducted solely by that firm.

Among the entries in the recent A.F.A. Student Engineering Essay Contest, sponsored by the Committee on Cooperation with Engineering Schools, was the following article on Magnesium Alloy Sand Castings, which was awarded second prize. Like all student papers, its presentation is not necessarily intended as a contribution to the technical literature of the industry, but rather as an incentive to other students and apprentices.

Some Developments in Theory and Practice of Magnesium Alloy Sand Castings

By Gerald Golden
Illinois Institute of Technology, Chicago

THE Bronze Age is past; the Iron Age is passing; the Third Metal Age is arriving—the Age of Magnesium.

Its raw materials are illimitable. Therefore, it must inevitably affect the technique of industrial production everywhere. Magnesium and its alloys have special properties which give engineers and designers new opportunities, and open still newer fields to the research worker and scientist.

The outstanding property is a low specific gravity—only two-thirds the weight of aluminum, only one-fourth the weight of cast iron. Add to this a high strength-to-weight ratio, ductility, high thermal and electrical conductivity, ease of fabrication and justification, for the coming Magnesium Age is evident.

The principles underlying sand foundry practices for magnesium alloys are generally similar to those used for other metals. However, the ultimate physical makeup, and a pronounced chemical reactivity give rise to certain exceptions. These points of difference are necessitated by a low density of the molten metal, which is slightly more than 1.5 at 1300° F., a comparatively high shrinkage, when unrestrained, of 3/16 in. per ft., and a high rate of oxidation at temperatures above the melting point of 1125° F.

The means by which these factors affect casting techniques will be treated in some detail in the following pages. Although all pertinent detail cannot be included, the following procedures will present magnesium sand foundry practice fairly completely.

History and Extraction

Magnesium was isolated as early as 1808 by the English chemist, Sir Humphry Davy, who gave a detailed report in his "Electrochemical Researches on the Decomposition of the Earths." However, the metal remained little more than a laboratory curiosity for over 100 years, due to the commercial difficulties in obtaining it.

In 1828, the French chemist, Bussy, submitted to the Academie Royale a sample of magnesium which he had produced by reducing anhydrous magnesium with potassium. By 1830, Bussy had also devised the production of anhydrous magnesium chloride from magnesia, carbon, and chlorine, a method upon which the present industrial manufacture of anhydrous magnesium chloride is based.

Veiled in Mystery

Although these discoveries occurred rather early, industrial development in the production of magnesium began only on a modest scale toward the close of the last century, when small quantities intended for pyrotechnic purposes were produced. The magnesium industry had its start in this country in 1915, but only in recent years has sufficient tonnage been produced to reduce the cost to a point where it can compete with other metals as an engineering material.

Having just emerged from the chrysalis, the details of magnesium extraction processes are shrouded in mystery but, broadly speaking, the following three methods are employed:

(1) *Electrolysis of fused chlorides.* In Germany, the double chloride or carnallite, $Mg.Cl_2.KCl.6H_2O$, is employed, being obtained from the Stassfurt deposits; while in America, $MgCl_2$ from Michigan brine wells is utilized.

(2) *Electrolysis of a solution of the oxide in molten fluorides.* The oxide is obtained by calcining magnesite, $Mg.CO_3$, or, as in recent developments, by special treatment of dolomite, $Mg.CO_3.CaCO_3$.

(3) *Reduction of the oxide in the presence of carbon.* In this process, the reduction takes place in an electric arc furnace in an inert atmosphere such as hydrogen, the gaseous metal being condensed and redistilled.

All of these processes produce magnesium of better than 99.9 per cent pure.

Magnesium forms alloys with most of the common metals yielding products with a wide range of properties. The composition of most of these alloys may be divided into two general groups: (a) Those having only one alloying addition, usually 10 to 12 per cent aluminum, or 5 to 6 per cent zinc, and (b) those having two or more alloying additions. These additions include aluminum and zinc in varying proportions, with other metals such as manganese and non-metals such as silicon.

A typical alloy in wide use for sand casting is Dowmetal C, or A.S.T.M. alloy No. 17. This alloy has the composition: Al 8.3

to 9.7 per cent; Zn 1.7 to 2.3 per cent; Mn 0.10 per cent; Si 0.5 per cent; the remainder Mg.

Magnesium, having a great affinity for oxygen, will react most violently with moisture. Therefore, it becomes necessary to add certain specified agents to the sand to prevent this interaction.

The first inhibitors were developed by German foundrymen, who discovered that sulphur and boric acid would protect magnesium base alloys cast in green sand. Later research has shown that a large number of chemicals, particularly various fluoride salts, will act as inhibitors.

Sand Agents

The agents added commonly include certain more or less volatile matter and, broadly speaking, may be divided into two groups. The first group includes those designed solely to give a neutral atmosphere adjacent to the metal. Representatives in this category are pitch, napthalene, and such volatile organic salts as ammonium oxalate. Sulphur also belongs to this class, and acts by filling the mold with the inert gas, sulphur dioxide.

In the second category are those compounds which disengage hydrogen fluoride while in contact with hot metal. This compound has a pacifying effect on the metal, and perhaps renders a protective coating of magnesium fluoride as well. Originally, ammonium acid fluoride and ammonium borofluoride were used for this purpose, but they have been replaced largely by the cheaper ammonium silicofluoride.

In addition to the two groups already mentioned, there is a third agent which seems to fall into both classes. Thus, boric acid not only yields a protective atmosphere, but also forms a superficial coating of magnesium borate on the melt.

Present practice seems to include part or all of the various inhibitors, according to individual practices. American foundries are using combinations of several agents, although practice holds to boric acid and sulphur. Exceptionally good results have been obtained with an equivalent mixture of sulphuric acid, borax, and sulphur. In green sands of low permeability, better protection has been obtained by replacing part of the sulphur and boric acid with fluoride salts.

Methods Vary

The amount of inhibiting agent required depends upon the sand used, and the section thickness of the casting produced. Generally, the larger the cross section and the less permeable the sand, the more inhibiting agent will be required. In most cases 4 per cent to 10 per cent by weight will be found satisfactory.

The method of adding these agents to the sand varies with the compounds used. When boric acid and sulphur mixtures are employed, they are added dry in the muller, but when ammonium fluoride is to be incorporated, the practice adopted is to prepare a saturated solution of the fluoride in water at 175° F., and add to the sand in sufficient amount to have a moisture content of 3.3 to 5.0 per cent.

The concentration of agent slowly decreases as the sand is used. Consequently, more agent must be added to maintain the proper degree of protection. This is done by holding the water soluble salts within set units, by the addition of ammonium silicofluoride and boric acid. The CS_2 soluble content of the sand determines the powdered sulphur additions.

Molding Sands

We are indebted to the French for a large volume of research upon sands for magnesium casting. The most desirable characteristics demanded are those associated with high permeability. The sand should be as open as possible, consistent with the required casting finish. A highly permeable sand is an essential which is dictated by the following three facts:

1. An open sand will reduce the back pressure of the air in the mold, thus facilitating the flow of the ultra-light molten metal into the mold cavity.

2. Much gas is evolved during cooling and solidification, particularly when the melt has contained a fair proportion of gates and risers.

3. Less tempering water is needed for an open sand, thus evolving less steam and, consequently, decreasing the tendency to reaction between steam and metal.

On the basis of their research, the French have insisted that the clay content of any natural sand used should not be higher than 15 per cent, with a moisture content of not more than 6 per cent. However, later experience proved that sands of even 10 per cent clay content are unsatisfactory for magnesium practice. For one thing, the water content required for temper is high, and this results in considerable steam formation as the mold is filled.

Controlling the Properties

The permeability of these sands is comparatively low, the resulting poor venting requiring the addition of an excessive amount of inhibiting agent. It is true that several magnesium foundries throughout the world have used natural sand, but all recent experiences have shown the definite advantages of synthetic sands in magnesium casting.

By the use of synthetic sands, the properties may easily be controlled. The base of the mixture is a washed silica sand, having the maximum silica content and of fairly large grain size.

Bond is added in the form of bentonite, a colloidal clay, which absorbs water, thus taking the place of the bond in natural sands. It is the variation in clay content and grain size which makes natural sands so uncertain in their behavior for magnesium molding purposes.

Synthetic sands, while entirely adequate from the permeability standpoint, tend to dry out easily and give rough surfaces on castings. This is overcome by the use of approximately 1 per cent ethylene glycol in the sand, which permits the use of less water and increases the workability of this sand by including a high resistance to evaporation.

It is stated by some sources that ethylene glycol additions

have further inhibitive action on oxidation, but that point is as yet a matter of contention.

After each use, the sand is conditioned, tempering, mulling, and aerating being done in standard equipment. The sand is freed from all foreign material before being returned to the molder, as these inclusions have a tendency to produce physical defects in the form of blows.

Melting Techniques

From these general details, it is evident that in developing a sand technique, it is essential to bear in mind two major considerations, uniformity in quality of the sands employed and the rectification of sand mixtures to secure the properties desired. A sure way of obtaining the correct values for the various properties of the sand—that happy compromise of physical and chemical properties—is to use synthetic sand.

The modern method of melting magnesium consists of two operations, melting and refining. Large melting units, which are gas or oil fired, are used for basic melting and have a capacity of 1,000 to 2,000 lb. From these units, of both the center tilting and nose tilting types, the metal is poured into small individual crucibles at about 1300° F. The small crucibles are then placed in their furnaces and the refining process of super-heating the metal to approximately 1650° F. is accomplished.

The crucibles are made of low carbon steel. They are used without any protective wash, molten magnesium being almost completely inert as regards to iron. Furnace design and combustion control should minimize scaling on the outside of crucibles. A violent reaction of the thermite type is to be expected if molten magnesium, from a leaking crucible, comes in contact with hot iron scale.

Care of the Crucible

The crucibles are examined thoroughly every day. The pot is filled with water and allowed to soak completely to remove encrusted oxides and nitrides. There is a noticeable reaction between the water and the encrustation and a pungent smell of ammonia from the action of the nitride. The crucibles are then dried thoroughly and brought to red heat. If, upon examination, portions of duller red than the general are indicated, flaws will no doubt be evident. If, on testing with a blunt hammer, a dent is formed, the crucible should immediately be scrapped.

If the crucible should pass this test, it should, nevertheless, be further tested when cooled to normal temperatures. This is done in a similar manner. The sound emitted on striking the metal with a hammer should be of uniform characteristics, the least difference being a possible indication of a discontinuity of the metal. At this spot, harder hammering should be performed to ascertain the presence of a soft spot. On the slightest denting, the crucible should be scrapped.

As described earlier, magnesium is the most readily oxidizable of the common metals, and ordinarily much magnesium oxide and nitride will be formed during the melting process. The purpose of magnesium fluxes is twofold. They are used for oxide and nitride removal or refining, and for covering the molten metal in order to isolate it from the action of the atmosphere.

Function of Fluxes

Among the fluxes for magnesium alloys, we find the chloride and fluoride salts. The basis of all magnesium fluxes is magnesium chloride. From the chemistry of magnesium it follows that all fluxes used must be in the anhydrous condition, otherwise there is danger of an explosive reaction.

The technique of fluxing is a determining factor in the production of good castings and generally occurs in the following manner: The charge of sprues and virgin metal is placed in the furnace and a sprinkle of flux is added. The function of this flux is to form a protective cover on the metal as it liquefies.

It will be found necessary to add a little flux from time to time, as the temperature rises, in order to achieve a continuous cover on the molten metal. At 1300° F the metal is poured into the small crucibles and is ready for refining.

The crucible is placed in a small gas or oil-fired furnace and flux equal to about 2 per cent of the metal charge is added. The metal is then stirred with a rod to give a rotational motion to the melt. During the stirring operation, flux is added in sufficient quantity to form a fairly heavy coating on top of the melt.

At the end of the refining process, if the stirring operation and fluxing is done properly, the metal will have a silvery luster. The flux residue is then scavenged from the crucible, or allowed to settle according to the physical properties of the flux. The important thing is to secure complete separation from the melt.

Threefold Action

The theory of fluxing is interesting. The action is probably threefold.

First, magnesium chloride can readily take up oxygen, thereby forming magnesium oxychloride. During fluxing, the formation of oxychloride proceeds at the expense of the oxide in the melt, and the molten flux is thickened at the same time. Secondly, oxide and foreign matter may be taken into combination, or absorbed in other constituents of the flux. The third action is probably a purification by absorption.

The initial process intimates mixing of the molten flux, dispersing it throughout the metal occluding microscopic and ultra microscopic particles and slowly precipitating these impurities during the flux-metal separation.

After stirring is completed, an iron-constanten or chromel-alumel thermocouple is inserted and the surface of the metal is covered with flux. Particular attention is given to the area near the crucible wall and thermocouple.

The crucible contents are then heated to approximately 1650° F. and allowed to cool to casting temperature between 1400 and 1600° F., consistent with the casting section to be poured. The superheating operation has a refining effect on the grain size

with the consequent advantageous mechanical properties.

When the crucible is ready for casting, the surface of the melt is cleaned by carefully removing the cover of flux and oxide. As the metal readily burns at this temperature (as soon as the flux cover is removed), steps must be taken to isolate it from the atmosphere. This is done by dusting the metal surface with a powder containing 80 per cent sulphur, 17.5 per cent boric acid, and 2.5 per cent ammonium borofluoride.

Care Against Burning

After the casting has been poured, the crucible is returned to the melting floor and cleaned, preparatory to charging. If proper casting practice has been followed, a heel of metal 2 in. or 3 in. deep is left in the crucible. The desirability of the residual metal is evinced by the following two facts:

1. The danger of flux inclusions in the poured metal is minimized.
2. The melting down of the next charge is facilitated.

The side walls are then spudded down, and the sludge and dross are removed from the crucible. During the cleaning operations, flux is added to the metal to inhibit burning. The crucible is now ready for the next cycle of operations.

Molding and Pouring Practices

The art of producing good magnesium alloy castings depends not only upon adequate use of risers and chills, but upon the chemical and physical properties of the metal as well. These latter considerations apply especially to molding and pouring techniques.

Because of the low heat of fusion, the metal must be poured at a sufficiently high temperature to produce castings free from misruns, although not so high as to introduce defects caused by sand attack and burning.

Normal pouring temperature lies between 1300 and 1600° F. A slight increase above 1600° F. is allowed for exceptionally thin walled castings, although generally the most suitable casting temperatures for the majority of castings is between 1350 and 1500° F. To combat sand attack and excessive burning, the casting must be gated efficiently to enable the metal to run smoothly into the mold.

Running methods which lead to turbulence must be avoided. Although this last requirement is desirable in the founding of all metals, it is of major importance in the production of sound magnesium castings. Turbulence of any kind has a tendency to increase oxidation, due to the increased exposed surface area. The resulting oxide skin formations, which have about the same specific gravity as the molten metal, do not separate but are swept into the mold, where they rise to the cope side and appear as surface defects after sand blasting.

Minimum Turbulence

Excessive turbulence also may trap bubbles of air, which appear as blows on the cope side after cleaning. Therefore, it is evident that the running and grating of magnesium alloy castings is a vital factor, and great consideration must be placed on the subsequent molding methods.

Good magnesium practice favors the increase of pressure of metal in the runners, by increasing the number of downgates, rather than by increasing the height or diameter of the sprue. If the downgate is unavoidably high, the free fall of metal should be broken by means of staggered steps.

The trend of modern practice is to gate the casting in a way that will bring it into the bottom of the mold with a minimum of turbulence. The runner channel is led into a blind end past the gate, where any dross that is carried from downgate is trapped. Clean metal then flows through the gate into the mold proper.

Patented methods of ensuring a steady flow of clean metal is to provide skimming appliances. These take the form of perforated skim gates and pads of steel wool. Skim gates are now used on all molds. Material for this purpose is 90 lb. sheet tin, with No. 4 or No. 6 perforations. Since either screen has approximately 30 per cent opening, the sprue must be flared at the screen to allow for this choke. The screen enjoys the double function of removing oxide particles and smoothing out the flow of metal.

The position of the skim gate is usually at the bottom of the downgate, and immediately adjacent to the runner. Pads of steel wool are usually used in conjunction with the screen.

The grain of the material and the thickness of the pad is dependent upon the size and feeding rate of the casting. The steel wool pad is usually placed above the skim gate at the bottom of the sprue, where it also acts as a cushion to prevent the metal from splashing.

Another factor of considerable importance is pouring technique. A correctly designed pouring basin must be used on all molds. They may vary in size from small cast iron ones on bench molds to large ones molded from green sand used on floor molds. Cast iron pouring basins are carefully preheated and kept dry, to prevent the molten metal from spattering.

Pouring Is Important

The basin should be designed to allow the metal to quiet down before entering the sprue, and also to allow pouring without direct impingement on the sprue. The metal should be poured perpendicular to the long axis of the pouring basin, and into that part of the basin opposite the sprue. Pouring directly into the sprue washes oxide skins into the mold, thereby increasing the possibility of oxide inclusions in the casting.

Now that we have discussed the preliminary methods of getting the metal into the mold, let us digress on the subject of gating practices.

By reasons of the properties of molten magnesium, castings must be run freely, and it is generally advisable to fill the castings through numerous small gates. This is desirable because molten magnesium loses its heat so rapidly that any attempt to

flow metal any great distance through a thin section of casting will result in misruns.

A common type of gating is to place a ring runner completely around the casting, with a number of gates entering the casting uniformly around its circumference. Care is taken to avoid sharp corners where the gate joins the casting for, as the mechanical strength of magnesium alloys at elevated temperatures is low, there is always a tendency for cracks, due to contraction, to occur at such places.

Venting facilities are also provided in the tops of runners to prevent the building up of back pressure. This is of special importance when molds are poured at high temperatures.

An Inherent Effect

It is standard practice to run magnesium castings from lower sections in order to achieve the previously discussed unbroken fall of metal. This puts the hottest metal at the bottom of the casting, and there will be a tendency for solidification to begin at the top.

This is contrary to normal ideas of the foundryman, although this tendency can be overcome by placing risers over the gates. However, the gating results will be favorable only when every portion of the solidifying casting is in contact with the liquid metal at any time during solidification.

Unfortunately, magnesium alloys at present suffer from an inherent effect; they have a protracted freezing range, conducive to intercrystalline cavitation or micro shrinkage. This occurs because freezing develops at a number of centers of solidification, with deposition of high point material, and continues in layers of constantly changing composition, each layer being richer in eutectic constituent and of lower melting point, until the growth of any one crystal is restricted by that of its neighbors.

At this point a liquid eutectic exists, surrounding a number of cored solid solution crystals. The crystals contract, starting where the casting is coolest, and the eutectic material flows toward the fissure to fill the partial vacuum created. Unless the hotter part of the casting is immediately adjacent to an adequate riser, it is thus impoverished of eutectic material and becomes unsound and porous.

To combat this effect, large risers and chills are utilized. Because of the light weight and low heat content of the metal, it is necessary that the riser be connected as directly as possible to the section to be fed. The number of risers, of course, varies with the size and shape of the castings but, undoubtedly, the riser-weight to casting-weight-ratio is larger for magnesium alloys than for any other metal.

Chills are used to equalize the freezing of heavy and light sections, the idea being to favorably dispose the temperature gradient towards directional solidification. They are usually made of cast iron, the thickness of the chill being dependent upon the thickness of the portion of the casting to be cooled, and upon the quantity of metal which flows past it while filling the mold.

The chills are usually rough and provided with holes in order to allow liquid metal to lie well. They are sandblasted before each use, and are usually preheated before closing the mold.

Core Practice

An open sharp sand is definitely the rule for core practice of magnesium casting. Most core troubles can be traced to failure to provide adequate venting facilities, or to lack of attention to details which insure a minimum of gas evolution.

In choosing a binder, first consideration must be given to the ease with which cores can be removed from the casting. The relatively low heat content of the metal will not burn out the core bond as in the casting of heavier metals. Generally, any good quality core oil is suitable for use, but preference should be given to those forming a minimum of gas evolution.

Wood resin binders are now being used with a marked degree of success. The resin bonded core bakes more quickly, leaves the core box cleaner, and shakes out easily. Cereal bonded cores find limited application as they tend to absorb moisture, requiring special care to keep them warm before using.

Core sand must be treated with an inhibitor to prevent burning of heavy metal sections. Two types of practice have been developed for obtaining inhibition.

First, low percentages of sulphur and boric acid are mated with core sand before making the core. Second, baked cores are sprayed with an aqueous solution of fluoride. The sprayed cores are then returned to the oven for a short drying period, 10 to 20 min.

In cases where very heavy metal sections contact the core, combinations of both practices are used. Sulphur is sometimes painted on parts of cores for additional protection. However, the danger of too heavy a sulphur coating, with the resulting bubble formation, reduces this practice to a limited extent.

A typical core sand mixture for general use follows:

Sand*	1000 parts
Oil	12 parts
Dextrine	8 parts
Sulphur	13 parts
Boric Acid	13 parts

Standard A.F.A. specimens, before and after baking two hours at 420° F. will approximate the following properties:

Permeability	85
Hardness	85
Baked Tensile Strength, psi.	120
Green Compressive Strength, psi.	0.3

The addition of more oil will, of course, produce a stronger core, but care must be taken to avoid excessively strong internal cores, as they may cause cracks in the casting after solidification. In general, the core should be as soft as possible, consistent with the increased fragility and difficulty in handling.

The temperature of baking is dependent upon the amount and kind of binder used but, generally, the cores are baked between 400 and 450° F. Due to the high dimensional accuracy re-

*The sand is a mixture of 60 per cent, with 65 average grain fineness, and 40 per cent with 100 average grain fineness. Moisture content from 6 to 7 per cent by weight.

quired, dryers are used most extensively.

To facilitate pasting, the joining surfaces are painted with a 1 to 3 shellac-alcohol solution to give a stronger surface. Care is taken that the paste does not come through to the surface of the core with resultant danger of a blow.

Shallow surface defects and joint lines may be smoothed with the following mixture, made up to a soft paste with denatured alcohol, containing a little lubricating oil for bond:

Sand (200 mesh)	75 parts
Talc	25 parts
Sulphur	2 parts
Boric Acid	2 parts

The pasted area is then thoroughly dried in the oven.

As in the case of molding practice, chills are placed in the cores where necessary, and may be a standard button shape or formed to fit the contour of the surface.

Precautions are taken to prevent condensation of moisture on the chill. This is best accomplished by the use of some type of coating, which must be thin and contain no material which will give off gas upon contact with hot metal.

A suspension of talc in alcohol containing 1 oz. of resin has been found to be a satisfactory coating material. The chill must be free from any rust or moisture.

Cores which do not go directly from the baking racks and assembly benches to the molding floor are stored in a dry, warm room, maintained at a temperature of at least 100° F. This minimizes moisture absorption and thereby eliminates the foundry troubles incident to damp cores.

Heat Treatment

Prior to 1934, the effects of heat treatment on the commercial alloys of magnesium were not fully understood, and it was frequently stated that no improvement in mechanical properties could be achieved by this means.

As a result of intensive research, more light was thrown on the equilibrium conditions between magnesium and its more important alloying constituents. This work proved conclusively that the alloys of magnesium, with aluminum and zinc, derive considerable benefits from both solution treatment, and secondary precipitation from the super saturated solid solution, or ageing treatment.

The heat treatment of magnesium alloys is, tersely, a process which needs careful control of temperature, the absolute exclusion of oxygen from the furnace atmosphere, and uniform heating throughout the charge being treated. This is usually effected in a gas tight furnace, employing an inert atmosphere to prevent reaction between oxygen and magnesium at elevated temperatures. For temperatures up to 800° F., it has been found that SO_2 at a concentration of approximately 0.5 per cent is satisfactory.

The furnace used is either electric or gas fuel operated, with a vertical type fan in the top to provide a gently circulating atmosphere. This circulation effect produces a constant degree of heat flow throughout the furnace and through the charge of castings under treatment.

Metal Is Plastic

Equal heating and elimination of "hot spots" is particularly important, if equivalent mechanical properties are to be obtained in the product.

Small castings can be placed on trays and treated normally, but larger castings must be provided with jigs or cast with tie bars. This is necessary because the metal is exceedingly plastic at the solution temperature, and bulky castings with heavy sections will naturally distort under their own weight, if uncontrolled.

The temperature and duration of solution heat treatment are dependent upon the alloy and cross section of the casting.

The preheating time can be considered as a "static" operation, and when it has elapsed the actual timing of treatment duration should be fixed. The "static" time should not be less than two hours, and the over-all times for two common magnesium sand casting alloys are:

Dowmetal H	12 hrs. at 730° F.
Dowmetal C	20 hrs. at 760° F.

Similarly, ageing or precipitation hardening treatment occurs at the following rates:

Dowmetal H	7 hrs. at 320° F.
Dowmetal C	12 hrs. at 350° F.

The properties obtained by heat treatment are both remarkable and interesting. The solution heat treatment results in increased ductility, tensile strength, and toughness without changing the yield strength or hardness. These properties will account for the high impact resisting characteristics of these alloys.

Subsequent Treatment of Castings

Further heat treatment, carried out on the solution heat treated alloy, will result in a precipitation process which augments the tensile strength but reduces the ductility.

Consequently, the sphere of usefulness of the solution heat treatment and aged castings is necessarily confined to the statically loaded components, as against the live load applications of the solution heat treated alloys.

After cooling for a safe period of time, following the pouring operation, the castings are shaken out by hand or on vibratory screens. The cores are then removed by vibrating with the aid of air and hand tools.

After being hot inspected, the castings are sandblasted or blasted clean. Spring tempered, metal cutting band saws, with 4 to 5 teeth per in. running at linear speed of 4,000 to 9,000 ft. per min., are then used to cut off the gates and risers. Care is taken to avoid core wires, skim gates, or other iron in the casting as the sparks thus induced would cause ignition.

On large castings, or on castings where protrusions cannot be reached with the band saw, chipping must be used. A cold chisel and hammer or a pneumatic chipping tool may be used. If heat treatment is required, it is usually done at this point before the final cleaning operations.

The cleaning room operations

consist of grinding, filing, and buffing. Saw marks, fins, and rough spots are ground smooth with the casting surface, and as much of the general cleaning operation as possible is done on the grinding wheels. Rough grinding is best done on grinding wheels with a grain size of about 20 to 30.

Surplus metal, fins, etc., which are inaccessible to the grinding wheels are removed with rotary filing tools. These machines afford much faster production than hand filing, and can be resharpened at considerable saving over new equipment. These rotary files are mounted on flexible shafts with adjustable speeds up to 3600 rpm.

If a smoother surface than that obtained by grinding and filing is required, the casting has to be polished. Polishing is done on felt wheels whose surface is covered with glue and rolled in different grades of aluminum abrasive.

Removing Fire Hazard

Grinding, filing, polishing, and similar operations produce a metallic dust that constitutes a fire hazard. Grinding and polishing wheels are provided with a dust collector which brings the dust into a spray of water as soon as possible. The overflow water from the dust collector goes into a settling tank where, upon removal, the sludge is mixed with 5 parts of sand and immediately buried.

After castings have been completely cleaned they are resand blasted to give a uniform surface appearance. Sand blasting magnesium alloys greatly increases the initial corrosion rate.

The addition of an acid pickling step at this point does much to overcome this high initial corrosion, thus improving the corrosion resistance provided by the subsequent chemical treatment.

In acid pickling, the castings are immersed for sufficient time to remove at least 0.002 in. per surface (0.004 in. per diam.). The pickling time will vary according to the concentration and activity of the pickling solution but, generally, castings are immersed for approximately 30 seconds at room temperature in a water solution containing 2 per cent concentrated sulphuric acid by volume.

As the amount of metal removed varies with the temperature and concentration of the pickling solution, the time required for pickling is checked at regular intervals by pickling a flat test specimen.

After acid pickling, the castings are washed in running water and will have a dark gray appearance. The casting is now ready for the final chrome-pickle treatment.

The chrome-pickle treatment consists of a simple dip operation requiring one-half to 2 min., according to the freshness of the solution. The bath consists of the following composition operated at room temperature (70 to 90° F.):

Sodium dichromate ($Na_2Cr_2O_7 \cdot 2H_2O$) ....1.5 lb.
Concentrated nitric acid..1.5 pts.
Water ....to make 1.0 gal.

After the dip, the parts are held above the tank for about 5 seconds. This allows the adhering solution to drain off and to produce a better colored coating.

The parts are then washed in cold running water, followed by a dip in hot water to facilitate drying. The treatment "passivates" and slightly etches the metal (0.0006 in. per surface, 0.0012 in. per diam.), resulting in a surface which affords protection against corrosion during storage and provides a suitable paint base for subsequent painting.

Correct Inspection Important

Owing to the fact that magnesium casting alloys are being increasingly used for highly stressed parts, the question of inspection becomes increasingly important.

The surest indication of the qualities and properties of a casting is provided by test bars taken from the casting itself, as well as by an examination of the structure at all critical points. However, since it involves the destruction of the casting, this method of inspection can be used only when developing the casting procedure for new patterns, or when taking sample tests in current production.

The principal non-destructive control methods, apart from a thorough inspection of the surface, are x-ray examination, casting on of test bars, pressure tests and oil boiling tests. In the pressure test, the casting is clamped in a pressure jig, and air or water pressure is introduced. A soapy mixture is then painted on with a brush and porous sections show up as air bubbles. These defects can often be corrected by shot blasting the porous section.

Castings Must Be Sound

Oil boiling takes the form of immersing the castings for a short time in hot machine oil at approximately 280° F., followed by sand blasting. Small shrink holes, cracks, and similar casting defects will often be revealed by patches of oil on the surface of the casting.

While improved gating and risering methods will go far in securing tight castings, recourse to impregnation is often resorted to as necessitated by design and soundness of particular castings. In this process the castings are placed in an autoclave, which is so designed that it will stand a high vacuum and pressure of about 100 psi.

When the castings are put in, they must be thoroughly dry. Then the autoclave is sealed and as perfect a vacuum as possible is put on—at least 28 in. of mercury—and left on for 10 or 15 min. Then hot tung oil, at about 210° F., is brought in to cover the castings.

After the castings are covered with the oil, they are subjected to 75 to 100 lb. air pressure for about 10 min. Then the pressure is taken off and the castings are removed from the tung oil bath, rinsed in kerosene and placed in an oil bath which is maintained at a temperature of about 475 to 500° F. They are left in the hot oil bath for 30 to 45 min., and are then taken out and rinsed in kerosene and are ready for the test. Sometimes they are soaked in kerosene after that impregnation.

During the evacuation process the air which is in the pores of

the castings is sucked out, leaving a vacuum in those pores. Then as the hot oil goes in and the pressure is put on, the oil is forced into the pores.

When the casting is taken from the tung oil bath, the pores are full of liquid tung oil. During the heating process in the hot oil bath, at about 475° F., the liquid tung oil is polymerized to a solid and remains a solid indefinitely.

Some alloys are less subject to intercrystalline shrinkage than others and, therefore, make it easier to produce pressure tight castings. Dowmetal C, or A.S.T.M. alloy No. 17, is an example of such an alloy, and it is especially suited to engine castings.

Conclusion

The art of founding is older than science, older perhaps than art, older than any system of philosophy we have on earth today. After thousands of years of dormant existence, the industry has thrown off the shackles of a craft and has made advances commensurate with those of a demanding civilization.

It is an industry which is so old that you can not find where it began, and yet so new that it challenges the best of our engineering skill, the best of our scientific research.

The foundry sciences are at last assuming their rightful place in the scheme of technology. Spurred by outside competition, the hard-earned discoveries of a new generation of technically trained men have definitely pointed to the foundry as the future medium of a better metals technology.

Along with this, magnesium alloys, with their increasing applications, point toward a new and greater Age of Man, which future historians may well term "The Light Metal Age."

L. B. Knight Now Lt.-Commander, U. S. Navy

LESTER B. KNIGHT, Vice-President of National Engineering Co., Chicago, has left the company for service in the U. S. Navy, according to announce-

L. B. Knight

ment by Bruce L. Simpson, President. Mr. Knight has accepted the commission of Lieutenant-Commander, U. S. Navy, and will serve with the Bureau of Ships, Washington, D. C., assisting the Navy in handling their foundry facilities.

Long associated with the foundry industry, Mr. Knight has been connected with National Engineering for the past 13 years, and has been most active with sand research work of A.F.A. He has served on the Executive and Advisory committees of the Foundry and Sand Research Committee, and on the various committees of the Association concerned with sand testing data.

It is also announced by the company that R. L. McIlvaine, Manager of Engineering Sales, has taken over Mr. Knight's duties.

Book Review

Symposium on Radiography, 6¼x9¼ in., cloth cover, 256 pages. Published by the American Society for Testing Materials, Philadelphia, Pa.

This volume — containing papers presented at the 1942 A.S.T.M. Annual Meeting, revised papers from the 1936 Symposium on Radiography and X-Ray Diffraction, and selected papers from other sources—was prepared to develop a better understanding of the performance and significance of radiographic tests by both producers and consumers.

Papers presented before the 1942 A.S.T.M. Annual Meeting include: "Some Applications of X-Ray Inspection to Production Problems," by Don M. McCutcheon; "Radiography of Welds and Weldments," by R. E. Lorentz, Jr.; "Some Calibration Data and Scatter Measurements for the Radiography of Magnesium Aircraft Castings," L. W. Ball; "A Correlation of the Mechanical Properties and Radiographic Appearance of Magnesium Alloy Castings," by R. S. Busk; "A Million-Volt Portable Radiographic X-Ray Unit," by E. E. Charlton and W. F. Westendorp; "High-Voltage X-Rays in the Boiler Shop," by O. R. Carpenter; "The Gamma-Ray Radiography of Welded High-Pressure Power Plant Piping," by R. W. Emerson; "An Investigation of the Apparatus Used in Radium Radiography," by L. W. Ball and D. R. Draper; "An Exposure Meter for X-Ray Radiography," by Herbert Friedman and Arthur L. Christenson; "Equivalent Penetrameters in Radiographic Testing," by Robert J. Schier and Gilbert E. Doan; "A Study of Cassette Design for the Radiography of Aircraft Castings," by L. W. Ball; "Precision Radiography — III," by Robert J. Schier and Gilbert E. Doan, and "X-Ray Film Evaluation," by Vance Danford. These papers are followed by discussions of the papers.

Papers from the 1936 Symposium include: "Miscellaneous Applications of Radiography and Fluoroscopy," by Herman E. Seeman; a revision of "The Principles of the Radiographic Process," by John T. Norton, and condensations of "Gamma-Ray Radiography and Its Relation to X-Ray Radiography," by Norman L. Mochel, followed by an appendix of instructions for radium radiography by C. W. Briggs and R. A. Gezelius, "Foundry Application of Radiography," by Earnshaw Cook, and "The Problem of Radiographic Inspection," by H. H. Lester.

"Industrial X-Ray Protection," by Lauriston S. Taylor, was reprinted from *A.S.T.M. Bulletin No. 99,* August, 1939.

"Proposed Recommended A.S.T.M. Industrial Radiographic Terminology," was developed cooperatively by the American Society for Testing Materials Committee E-7 on Radiographic Testing, the American Foundrymen's Association Committee on Radiography, and the X-Ray Section of the Canadian Research Council.

New Association Members

A.F.A. Chapters (20 of them) reported a total of 108 new members for the period of August 16-September 15 . . . an excellent end-of-summer record! In addition, this total contrasts with 65 new nembers in the same period last year. Leading the field was Southern California with 17 new members. Chicago reported 14, including four Company members. Michiana turned in three new Company memberships. Continued interest from the South Pacific is shown by six new Australia and New Zealand members, one of them a Company member.

(August 16 to September 15, 1943)

Conversions

Sustaining from Company

Hickman, Williams & Co., Cleveland

Kelsey-Hayes Wheel Co., Detroit (O. E. Goudy, Fdry. Supt.)

Company from Personal

***Clare Bros. & Co. Ltd., Preston, Ont. (W. W. Nobbs)**

Birmingham Chapter

Tom W. Lindsay, Foreman, Stockham Pipe Fitting Co., Birmingham, Ala.

Woodrow Stevins, Stockham Pipe Fitting Co., Birmingham

Henry W. West, Cupola Foreman, Stockham Pipe Fitting Co., Birmingham

Central Indiana Chapter

E. L. Tuck, Fdry. Engr., Tabor Mfg. Co., Philadelphia

Central New York Chapter

John A. Cleary, Mgr., Oneida Lake Sand Mines, Cleveland, New York.

***Oberdorfer Foundries, Inc., Syracuse, N. Y. (Kenneth Digney, Pres.)**

Lloyd O. Poland, Dir. of Laboratories, Oberdorfer Fdries., Inc., Syracuse, N. Y.

Chesapeake Chapter

John S. Thornton, Molder, Norfolk Navy Yard, Portsmouth, Va.

Chicago Chapter

***Alloys Foundry Co., Chicago (C. B. Carter, Pres.)**

George W. Boase, Gen. Foreman, Carnegie-Illinois Steel Corp., Chicago

***Bronze, Inc., Chicago (Leonard N. Grosse, Pres.)**

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F. J. Eberle, Cleang. Room Foreman, Continental Roll & Steel Fdry. Co., E. Chicago, Ind.

Benjamin G. Jarvis, Salesman, Sivyer Steel Castings Co., Chicago

Peter P. Jasis, Engr., American Steel Foundries, E. Chicago, Ind.

A. H. Kelling, Corn Products Refining Co., Argo, Ill.

***The Moore Corp., Joliet, Ill. (Charles Schreiner, Asst. Wks. Mgr.)**

M. M. Mrvichin, Project Engr., Pettibone Mulliken Corp., Chicago

Leslie C. Smith, Peninsular Grinding Wheel Co., Chicago

C. R. Taylor, Mgr., Whiting Corp., Harvey, Ill.

Arthur I. Thuren, Swan Finch Oil Corp., Chicago

***U. S. Gypsum Co., Chicago (J. S. Offutt, Mdse. Mgr.)**

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Bennett Peckinpaugh, Gen. Foreman, Melting Dept., Wright Aeronautical Corp., Lockland, Ohio

Stanley L. Rau, Fdy. Field Engr., Wright Aeronautical Corp., Lockland, Ohio

August Rossetti, G. H. R. Fdry. Div., Dayton Malleable Iron Co., Dayton

Harold Saurer, Metallurgist, Dayton Malleable Iron Co., Dayton

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Edward K. Pryor, Chas. Taylor Sons Co., Cincinnati

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Willis Walter Woodman, Sand Control Foreman, Pontiac Motor Co., Pontiac, Mich.

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Roland Choquette, Asst. Foundry Foreman, Warden King Ltd., Montreal

Charles W. Fordham, Foreman Radiator Core, Warden King Ltd. Montreal

Emile Gervais, Sand Control, Warden King Ltd., Montreal

G. E. Gunton, Mgr., Charles Tennant & Co. Ltd., Montreal

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William J. O'Toole, Inspector, American Steel Castings Co., Newark

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Vincent Tripodi, Foundry Layout Man, American Steel Castings Co. Newark

Milton Warman, Molder, Bendix Aviation Corp., Bendix, N. J.

Michiana Chapter

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***Elkhart Brass Mfg. Co., Elkhart, Ind. (John Rush, Supt.)**

***Modern Pattern Works, Elkhart, Ind. (Chas. A. Kraft, Owner)**

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Joseph J. Keenan, Foreman, National Aluminum Cylinder Head Co., Cleveland

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Gene Hassler, Chief Chemist, General Motors Corp., Oakland

Ralph Hultgren, Assoc. Prof. Phys. Metallurgy, University of California, Berkeley

Herman H. Klemm, Molder, Enterprise Engine & Fdry. Co., Richmond

E. W. Russell, Enterprise Engine & Fdry. Co., Richmond.

Northern Illinois-Southern Wisconsin Chapter

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Ontario Chapter

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W. F. Kelly, Works Mgr., American Manganese Steel Div., New Castle, Del.

John S. Roberts, Metallurgist, American Manganese Bronze Co., Philadelphia

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St. Louis District Chapter

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H. Gruner, Works Mgr., American Manganese Steel Div., St. Louis

Arthur Markworth, Foundry Pattern Foreman, American Steel Foundry Co., St. Louis

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James F. Cornwell, Foreman, Warman Steel Casting Co., Vernon
Robert G. Davidson, Foreman, Warman Steel Casting Co., Vernon
John J. Derkin, Foreman, Warman Steel Casting Co., Vernon
Henry E. Francis, Mgr., Pattern Service Co., Los Angeles
G. W. Garren, Los Angeles Steel Co., Los Angeles
Alfred S. Geldman, Chief Chemist & Metallurgist, Westlectric Castings Inc., E. Los Angeles
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Maurice F. Kerwin, Safety Engr., Los Angeles Steel Casting Co., Los Angeles
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Outside of Chapter

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(Miss) Lillian Bromund, Research Dept., Allis Chalmers Mfg. Co., West Allis, Wis.
(Miss) Carol A. Clapp, Research Dept., Allis Chalmers Mfg. Co., West Allis, Wis.
Leonard Elvage, Foundry Tech., General Motors Holdens, Woodville, South Australia, Australia
R. A. Garrison, Supt., Adirondack Foundries & Steel, Inc., Watervliet, N. Y.
R. L. George, Gen. Mgr., Bundaberg Foundry Co. Ltd., Bundaberg, Queensland, Australia
Dr. C. R. Kent, Chief Chemist, W. A. Government Railways, Midland Junction, Western Australia
Brunsel Letukas, 2d Class Petty Officer, U. S. Navy, San Francisco
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J. Reich, Gen. Foundry Foreman, Adirondack Foundries & Steel, Inc., Watervliet, N. Y.
G. L. Richter, Metallurgist, Farrel-Birmingham Co., Ansonia, Conn.
(Miss) Ruth L. Schulze, Research Dept., Allis Chalmers Mfg. Co., West Allis, Wis.
H. J. Thomas, Christchurch, New Zealand
W. W. Weller, Prod. Mgr., Adirondack Foundries & Steel, Inc., Watervliet, N. Y.

Book Review

1021 Answers to Industrial Health and Safety Problems, 6¾x9¾ in., cloth binding, 700 pages and a supplementary "Equipment Index." Published by Occupational Hazards, Inc., Cleveland. Price, $10.00.

Wide-spread recognition of the worth of the slogan "There's Profit in Prevention" is evidenced in the increasing safety measures being adopted by industry. Wise management has grown to realize that the day when illness and accidents, incurred during working hours, could be passed off as the individual employee's responsibility are gone.

Experience has shown that the health of employees is as essential to production and successful operation as smooth running machinery. The investment in industrial safety and health, therefore, is being viewed as a logical operating expense, one that is considerably less costly than work stoppages or lowered work quality.

1021 Answers to Industrial Health and Safety Problems deals with the physical fitness of industrial workers. Written in the layman's language, it treats of subjects relating to health and efficiency, in the form of questions and answers, that are of keen interest to safety engineers and department heads whose own measure of success is the well being of subordinates.

Since skin diseases are among the most common afflictions of industrial workers, this subject is given a comprehensive analysis, from the usual causes to preventative safeguards. Sources of published material, for additional reference, are presented at the close of the chapter.

The same careful treatment is given to dust hazards, showing which concentrations may be construed as harmful to workers. This is augumented by control measures, offered by the various kinds of ventilating systems.

Metal poisoning, toxic gases and vapors, and solvents are also discussed, the numerous queries and replies unfolding information on related phases of the different topics.

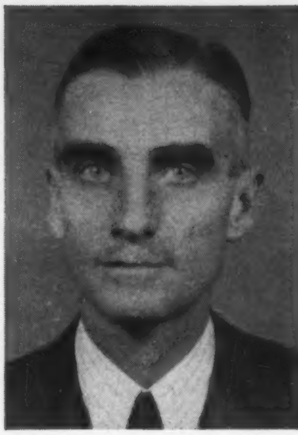
The problems of protective equipment, both personal and actual installations, are presented, with insight into existing methods of operation which are governed by the principles of safety.

In the chapter "On the Record," several forms are reproduced to acquaint management with prevailing systems for determining the sources of accidents and keeping an individual check upon employees and conditions which are responsible for their occurrence.

Aptitude tests of employees for various kinds of work and plant publications, or house organs, are factors which the editors consider of benefit in reducing the average accident toll.

CHAPTER OFFICERS

H. B. Caldwell
Whiting Corp.
New York City
Treasurer
Metropolitan Chapter



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Canadian Car & Foundry Co., Ltd.
Montreal, Canada
Director
Eastern Canada and Newfoundland Chapter

Chas. R. Hilb
H. Kramer & Co.
Cincinnati, Ohio
Director
Cincinnati Chapter

H. L. Creps
Frank Foundries Corp.
Moline, Ill.
Secretary-Treasurer
Quad City Chapter

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Covel Mfg. Co., Inc.
Benton Harbor, Mich.
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Michiana Chapter

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National Malleable & Steel Castings Co.
Indianapolis, Ind.
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Central Indiana Chapter

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Northeastern Ohio Chapter

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Director
Eastern Canada and Newfoundland Chapter

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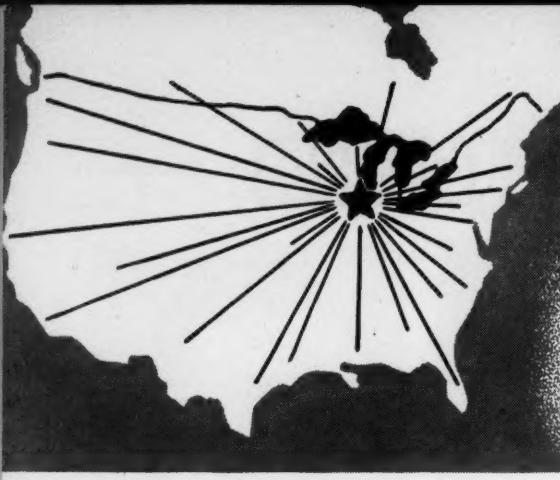
Eclipse Aviation Div.,
Bendix Aviation Corp.
Bendix, N. J.
Secretary
Metropolitan Chapter

R. L. Palmer
Federal Foundry Co.,
Div. of American Stove Co.
Indianapolis, Ind.
Director
Central Indiana Chapter



CHAPTER ACTIVITIES News

See page 27 for list of Chapter representatives whose reports of local activities appear in this issue.

Southern California's Summer Stag Creates High Attendance Record

By B. O. Bender

OVER 500 members and their guests turned out for the Summer Stag sponsored by the Southern California Chapter, held at the Lakewood Country Club on August 7, to smash all previous attendance records.

The weather man cooperated so that traditional California sunshine ushered in the occasion, with activities beginning early in the afternoon, under the direction of Bill Emmett, Los Angeles Steel Casting Co., chairman of the Entertainment Committee.

W. G. McLean, Snyder Foundry Supply, Los Angeles, supervised the "gold" activity, and many miles were covered on the golf links that day, as the different groups competed for prizes.

There was a well-rounded schedule of activities, from wooden horse races to ballad singing, with awards for those excelling in the contests.

The enjoyment of a turkey dinner, served in the main dining room of the club, was enhanced by distribution of door prizes to holders of tickets bearing lucky numbers. A sparkling stage show served as a climax to a day of fun and relaxation.

Despite the success of the outing, the gathering missed the presence of two prominent chapter officers who were unable to attend—President Walter F. Haggman, Foundry Specialties Co., Huntington Park, Calif., because of an emergency appendectomy, and Secretary E. M. Hagener, General Metals Corp., Los Angeles, whose severe cold prevented his coming.

Round Table Meeting Opens Cincinnati Season

By Martin F. Milligan

WHEN Chapter President Edward A. King, Hill & Griffith Co., Cincinnati, called the Cincinnati Chapter's Round Table Meeting to order, Septem-

There weren't any dull moments at the Summer Stag sponsored by the Southern California Chapter, as these candid camera views will attest. The novel wooden horse race, however, did not produce any "long shot" winners as the mounts scampered across the picturesque turf track.

ber 13, the 1943-44 season was officially opened.

The short business meeting was followed by a talk given by Gregor Ziemer, whose European background and world travels enabled him to present an interesting and intimate picture of Nazi Germany.

New England Foundrymen Hold Season's 1st Meeting

By Merton A. Hosmer

THE New England Foundrymen's Association held its first meeting of the current season at the Engineer's Club, Boston, Mass., on September 8. A. W. Calder, New England Butt Co., Providence, R. I., president of the group, presided.

Guest speaker of the occasion was Hugh Johnston, Pneumatic Tool Div., Ingersoll-Rand Co., Boston, whose paper, "Care and Use of Pneumatic Tools in the Foundry," included a discussion of pneumatic sand rammers, chipping hammers, grinders and hoists.

Mr. Johnson explained that considerable development work is being carried on at the pesent time in connection with pneumatic tools and that, in all probability, many of the new ideas will contribute materially in the future to labor saving and reduction of operating costs in the foundry.

He further stated that "two of the most common difficulties experienced where pneumatic tools are employed are (1) inadequate air supply and (2) leaks in the air supply system. The former can be corrected by enlarging the pipe or running parallel pipe lines, the latter by making frequent tests of running the compressor with the plant shut down in order to determine how much air is lost through leaky pipes, hose and connectors. A good rule to follow in selecting the pipe size is to use at least ½-in. pipe for rammers and chippers and at least ¾-in. pipe for grinders and hoists."

Over 300 Attend the W. Michigan Outing

OVER 300 foundrymen attended the outing of the Western Michigan Chapter on August 28.

In addition to golf, boat rides on Spring Lake, adjoining the country club of that name where the outing was held, afforded interesting relaxation. A ball

Bill Johnson, Oliver Farm Equipment Co., South Bend, Ind., chairman of the Entertainment Committee, arranged a diversified program for the annual Michiana Outing, September 11, with fly casting enthusiasts vying for honors.
(Photos courtesy American Foundry Equipment Co.)










game also was provided, but at press time we have no information as to which team won.

Prizes were distributed just before the buffet dinner outside the clubhouse, where C. J. Lonnee, Clover Foundry Co., presided at the microphone. Before the prizes were awarded, Chapter Chairman Harold C. BeMent, Campbell, Wyant & Cannon Foundry Co., Muskegon, and other officers and members of the Chapter were called upon for a few fitting remarks.

Following the buffet dinner, all returned home declaring the outing to have been a huge success.

Northeastern Ohio Holds Open Meeting

By Edwin Bremer

OVER 175 members and guests attended the opening meeting of the Northeastern Ohio Chapter at the Cleveland Club, Cleveland, September 9, at which James G. Goldie, chapter president, presided.

Louis B. Seltzer, editor of the *Cleveland Press,* gave a coffee talk on the various means by which metropolitan newspapers gather war news.

The chairman of the technical session, R. F. Lincoln, Osborn Mfg. Co., Cleveland, introduced the principal speaker, E. T. Kindt, Kindt-Collins Co., Cleveland.

Mr. Kindt's subject, "Timely Information Concerning the Pattern Industry," brought out the value of patternmaking to the industry and the savings in operating costs that are possible through correct technique and proper equipment.

He said that, while the role of the patternshop is important to the industry, its worth is not fully appreciated, but that the condition can be remedied through progressive action. According to Mr. Kindt, the average patternmaker will be benefited by an educational program in modern molding methods, in modern business methods and general industrial trends.

Such a program should be directed for the general good of the industry so that there will be full cooperation and understanding between patternmakers and foundrymen.

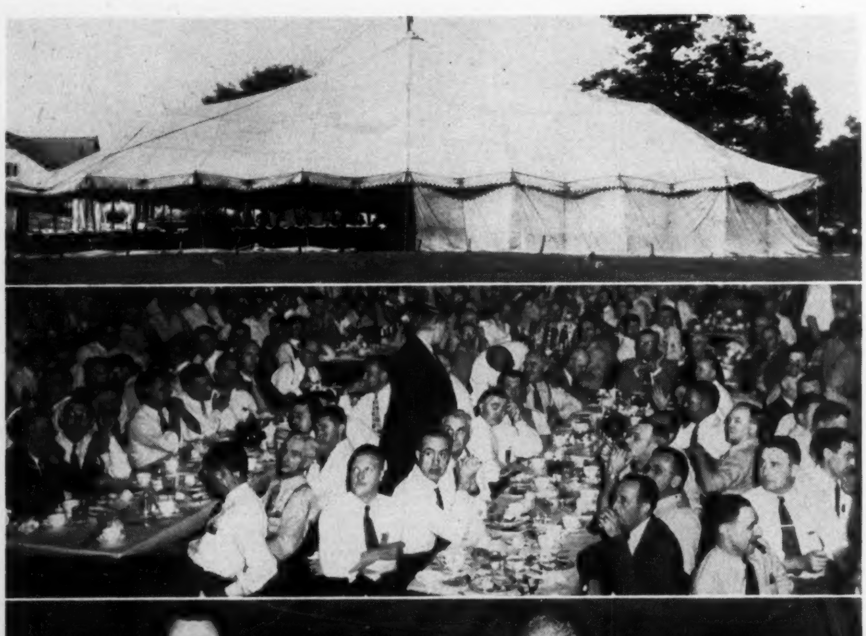
Following the talk, Mr. Kindt showed a motion picture dealing with the production of pattern equipment and supplies.

(Photos courtesy John Bing, A. P. Green Fire Brick Co.)
Enthusiastic golfer-members of the Milwaukee Malleable Club were blessed with perfect weather when the club held its annual outing June 19 at Meadowbrook Country Club, Racine, Wis.

Chicago Still "Batting 1,000" at Annual Picnic

THE Entertainment Committee of the Chicago Chapter, of which D. A. Farrell, Carnegie Illinois Steel Corp., Chicago, is chairman, chose August 21 as the date for the Chapter outing at Lincolnshire Country Club, Crete, Ill. The weather man cooperated and supplied a beautiful, sunshiny day so that over 1,000 foundrymen of the Chicago Metropolitan area could gather and enjoy themselves in release from their strenuous daily routine.

In addition to the golf tournament, in which over 350 participated, various other amusements were offered, such as horse shoes. For the non-golfers, games of skill proved an attraction. Dinner was served to 998, who enjoyed the floor show provided for the occasion.



(Photos courtesy Clyde Thomas, Whiting Corp.)
Laughter and good fellowship again prevailed under the folds of the famous "big tent" at the Chicago Chapter Outing, August 21. Left to right, awarding prizes; Glenn Kramer, American Manganese Steel Div.; Entertainment Committee, Dan Farrell, and Harry Cullen, both of Carnegie-Illinois.

All present congratulated the Entertainment Committee not only on the choice of the day, but on the excellent program presented. As usual, Harry Cullen, Carnegie Illinois Steel Corp., did yeoman service in handling many of the details for the "big show."

Reporters on Chapter Activities

Officers and representatives of A.F.A. chapters and other foundry groups who sent in the reports of local activities, shown in the *Chapter Activities News* section, are identified below:

Cincinnati—Martin F. Milligan, The Lunkenheimer Co., Cincinnati; Chapter Secretary.

Eastern Canada & Newfoundland—Robert W. Bartram, Robert W. Bartram Ltd., Montreal; Honorary Chapter Chairman.

New England Foundrymen's Association—Merton A. Hosmer, Hunt-Spiller Mfg. Corp., Boston.

Northeastern Ohio—Edwin Bremer, *The Foundry*, Cleveland; Chairman Publicity Committee.

Northern California—Geo. L. Kennard, Northern California Foundrymen's Institute, San Francisco; Chapter Secretary-Treasurer.

Quad City—H. L. Creps, Frank Foundries Corp., Moline, Ill.; Chapter Secretary-Treasurer.

St. Louis District—J. H. Williamson, M. A. Bell Co., St. Louis; Chapter Secretary-Treasurer.

Southern California—B. O. Bender, Advance Aluminum & Brass Co., Los Angeles; Chapter Publicity Secretary.

Texans Await First Area Meeting Oct. 29

ALL foundrymen of the Texas area are invited to attend the first meeting of the new Texas foundry group, to be held at the Rice Hotel, Houston, October 29. Large attendance is expected, beginning with a "get-together" at 5:30 p.m., dinner to be served at 6:30.

Those unable to attend the dinner are welcome to attend the technical session and discussion to follow, featured by R. G. McElwee, Vanadium Corp. of America, Detroit, as the principal guest speaker, on "Foundry Problems." No doubt future activities of the new foundry group also will be taken up.

The work of organizing the group and the October 29 meeting is being carried on by a Texas committee headed by F. M. Wittlinger, Texas Electric Steel Co., Houston. Vice-Chairman is J. O. Klein, of Texas Foundries Inc., Lufkin, (not with Lufkin Foundry & Machine Co., as stated erroneously in the September issue of *American Foundryman*). H. L. Wren, Barada & Page, Houston, is acting as Secretary, and other members of the committee are as shown below:

A. S. Cramer, Dickson Gun Plant, Houston.

L. H. August, Hughes Tool Co., Houston.

Wm. Bryant, Jr., Oil City Brass Works, Beaumont.

H. F. Elmer, Dedman Foundry & Machine Co., Houston.

W. A. Raymond, Houston Foundry & Machine Co., Houston.

T. J. Russell, Service Pattern Works, Houston.

It is expected that additional meetings of the group will be held at centrally located Texas cities, their frequency depending somewhat on the interest displayed in the October 29 meeting.

Northern California to Study Local Sands

By Geo. L. Kennard

THE first meeting of the Northern California Chapter's new year, held at the Engineer's Club, San Francisco, was

Old friends and new met on the New Ozaukee Country Club links, July 16, when the Wisconsin Chapter held its 8th Annual Golf Furlough.

(Photos courtesy John Bing, A. P. Green Fire Brick Co.)

attended by a total of 92 members and guests.

Chapter President Harry A. Bossi, H. C. Macaulay Foundry Co., Berkeley, California, presided. Special guests included past presidents Chas. Hoehn, Enterprise Engine & Foundry Co., San Francisco, Fred A. Mainzer, Pacific Brass Foundry of San Francisco, and several committee chairmen.

A considerable number of shop men attended, including the president of the local molders' union, and learned first-hand that A.F.A. is essentially an association of operating men. Many shop men are becoming A.F.A. members for the educational benefits available.

A plan, recently endorsed by the chapter directors was explained. The foundrymen will appoint a "Foundry Sands and Molding Materials" committee, composed of shop men, to make independent studies of the local sands, calling for assistance upon dealers whose cooperation was assured. The committee will present the result of the analyses as a feature at one of the chapter's ensuing programs.

Secretary George Kennard reported that in addition to the regular monthly bulletin prepared by Publicity Chairman Richard Vosbrink, Berkeley Pattern Works, Berkeley, California, each member is to receive a supplementary chapter financial report.

Program Chairman David B. Reeder, Electro Metallurgical Sales Corp., San Francisco, introduced the principal speaker of the evening, Andrew Ondreyco, Vulcan Foundry Co., Oakland, Calif. Mr. Ondreyco's talk gave first-hand knowledge of Australian foundry practices and that country's industrial developments and customs, as compared with those in the United States. Slides of pictures he had taken during his stay in Australia were shown as practical illustrations of foundry methods.

Dietert Speaks at 1st Meeting of Quad City

By H. L. Creps

MEETING at the Hotel Fort Armstrong, Rock Island, Ill., on September 20, some 102 members and guests attended the first session of the Quad City Chapter for the 1943-44 season. Chapter Chairman W. E. Jones,

War Problems Committees of A.F.A. Chapters

Birmingham District

Chairman, Dr. J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham.

Central Indiana

Chairman, Harold Lurie, Cummins Engine Co., Columbus

Castings Specifications

Harold Lurie, Cummings Engine Co., Columbus.

Gray Iron

R. H. Bancroft, Perfect Circle Co., Newcastle.

Malleable Iron

S. C. Wasson, National Malleable & Steel Castings Co., Indianapolis.

Steel Castings

I. R. Wagner, Electric Steel Castings Co., Indianapolis.

Brass

Chas. Beckett, Beckett Bronze Co., Muncie.

Aluminum and Magnesium

Chas. Gisler, C. & G. Foundry & Pattern Works, Indianapolis.

Chesapeake

Chairman, E. W. Horlebein, The Gibson & Kirk Co., Baltimore, Md.

Steel

H. F. Taylor, Naval Research Laboratory, Washington, D. C.
T. C. Worley, Bethlehem Steel Corp., Sparrows Pt., Md.

Gray Iron

Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.
F. G. Roemer, The Balmar Corp., Baltimore, Md.

Malleable Iron

David Tamor, American Chain & Cable Co., York, Pa.

Brass, Bronze and Aluminum

Earl J. Bush, Washington Navy Yard, Washington, D. C.
A. H. Hesse, Naval Research Laboratory, Washington, D. C.

Patterns

J. O. Danko, Danko Pattern & Mfg. Co., Baltimore, Md.
J. A. Heard, Crown Cork & Seal Co., Inc., Baltimore, Md.

Welding

Clyde L. Frear, Bureau of Ships, Navy Dept., Washington, D. C.

Job Training

D. F. Lane, Bethlehem Steel Corp., Sparrows Point, Md.
Geo. L. Webster, Baltimore Polytechnic Inst., Lutherville, Md.

Sand

C. M. Saeger, Jr., Bureau of Standards, Washington, D. C.

Chicago

Chairman, E. R. Young, Climax Molybdenum Co.
Vice-Chairman, L. L. Henkel, War Production Board
Secretary, N. F. Hindle American Foundrymen's Assn.

Brass and Bronze

H. M. St. John, Crane Co.
C. K. Faunt, Christensen & Olsen Foundry Co.

Steel

L. H. Hahn, Sivyer Steel Casting Co.
F. S. Sutherland, Continental Roll & Steel Foundry Co., East Chicago, Ind.

Malleable

L. J. Wise, Chicago Malleable Castings Co.
W. D. McMillan, International Harvester Co., McCormick Works.

Cast Iron

L. H. Rudesill, Griffin Wheel Co.
J. H. Gellert, Nichol-Straight Foundry Co.

Aluminum

G. H. Starmann, Apex Smelting Co.

Magnesium

Dr. R. F. Thomson, Chrysler Corp., Dodge-Chicago Plant.

Sand

G. H. Curtis, Chrysler Corp., Dodge-Chicago Plant.

Cincinnati

Chairman, Stanton T. Olinger, Cincinnati Gas & Electric Co.

Gray Iron

Jos. Schumacker, Cincinnati Milling Machine Co.

Non-Ferrous

Ed Korten, Reliable Pattern & Foundry Co.

Pattern Making

Charles Appel, The Lunkenheimer Co.

Alloys

Earl Kindinger, Williams & Co., Inc.

Pig Iron

Robt. Ebersole, Miller & Co.

Scrap Iron

L. W. Pryse, Hickman Williams & Co.

Steel

J. B. Caine, Sawbrook Steel Castings Co.

Detroit

Chairman, F. A. Melmoth, Detroit Steel Casting Co.

Steel

Ernest Lancashire, Detroit Steel Casting Co.
R. J. Wilcox, Michigan Steel Casting Co.

Gray Iron

V. A. Crosby, Climax Molybdenum Co.
L. W. Thayer, Cadillac Motor Car Div.

Malleable

C. F. Joseph, Saginaw Malleable Iron Div., Saginaw, Mich.
G. L. Galmish, Michigan Malleable Iron Co.

Aluminum and Magnesium

M. E. Brooks, Dowmetal Foundry, Bay City, Michigan.

Brass and Bronze

J. P. Carritte, Jr., True Alloys, Inc.

Metropolitan

Chairman, J. S. Vanick, International Nickel Co., New York

Aluminum, Magnesium, Light Metals

R. E. Ward, Bendix Aviation Corp., Bendix, New Jersey.

Steel

K. V. Wheeler, American Steel Castings Co., Newark, N. J.

Brass and Non-Ferrous Foundry

D. E. Broggi, Neptune Meter Co., Long Island City, N. Y.

Brass and Non-Ferrous Castings

S. Frankel, H. Kramer & Co., New York.

Pig Iron

N. Anderson, Debevoise-Anderson Co., New York.

Cupola Practice and Foundry Equipment

H. A. Deane, American Brake Shoe & Foundry Co., Mahwah, N. J.
D. J. Reese, International Nickel Co., New York.

Pressure Castings

R. J. Allen, Worthington Pump & Machinery Corp., Harrison, N. J.

Gating and Risering Small Castings

W. T. Dette, Robins Conveying Belt Co., Passaic, N. J.

Gating and Risering Heavy Gray Iron Castings

J. W. Reid, R. Hoe & Co., Dunnellen, N. J.
David MacIntosh, Sacks-Barlow Foundries, Inc., Newark, N. J.

Ordnance Steel Foundry Co., Bettendorf, Iowa, presided, the technical meeting being preceded by a short color movie of game hunting.

Featured speaker of the evening was H. W. Dietert, Harry W. Dietert Co., Detroit, who spoke on "Behavior of Molding Sands and Cores at Elevated Temperatures." Mr. Dietert outlined modern methods of determining hot strength, deformation and expansion of various sand mixtures at pouring temperatures, and offered suggestions for correcting molding and core practice.

An interesting and informative discussion period followed presentation of the speaker's talk and accompanying moving pictures.

St. Louis Hears Pat Dwyer at 1st Meeting

By J. H. Williamson

THE St. Louis District Chapter of A.F.A. held its first meeting of the current season at the DeSoto Hotel, St. Louis, September 9, the meeting being opened by Chapter Chairman L. A. Kleber, General Steel Castings Corp., Granite City, Ill. Chairman Kleber introduced the new officers and committee members and then called on various committee chairmen for reports on their planned activities.

Chapter Vice-Chairman E. E. Ballard, National Bearing Metals Co., St. Louis, reported for the Program Committee that an excellent program has been arranged. A. E. Hilliard, M. A. Bell Co., Chairman of the Entertainment Committee, spoke of plans underway for the annual Christmas Party in December. Walter A. Zeis, Midwest Foundry & Supply Co., as Chairman of the Membership Committee reported an all-time high in chapter members.

Winner of the National A.F.A. Apprentice Contest in patternmaking, Ralph Peterson of City Pattern & Model Co., St. Louis, was present on invitation to receive the A.F.A. certificate award. Chairman Kleber made the presentation and expressed the chapter's pride in the young man's accomplishment.

An excellent attendance enjoyed the technical talk of the evening on "Gates and Risers," presented by Pat Dwyer, *The*

War Problems Committees of A.F.A. Chapters (Cont.)

Cores, Sand, Refractories
W. G. Reichert, W. G. Reichert Engineering Co., Newark, N. J.

Government Specifications
N. A. Kahn, U. S. Navy Yard, Brooklyn, New York.

Heat-Resisting Alloy Castings
E. Cook, American Brake Shoe & Foundry Co., Mahwah, N. J.

Michiana

Chairman, R. E. Patterson
Elkhart Fdry. & Machine Co., Elkhart, Ind.

Advisory, Dr. E. G. Mahin,
University of Notre Dame, South Bend, Ind.

Magnesium, Aluminum and Brass
A. T. Ruppe, Bendix Products Div., Bendix Aviation Corp., South Bend.

Steel
Herman Hess, Clark Equipment Co., Buchanan, Mich.

Malleable and Gray Iron
J. E. Drain, Oliver Farm Equipment Co., South Bend.

Northeastern Ohio

Chairman, F. G. Steinebach,
The Foundry, Cleveland.

Gray Iron
A. C. Denison, Fulton Foundry & Machine Co., Cleveland.
F. J. Dost, Sterling Foundry Co., Wellington, Ohio.
Wm. J. Feth, Forest City Foundries Co., Cleveland.

Malleable Iron
F. A. Stewart, National Malleable & Steel Castings Co., Cleveland.
J. H. Lansing, Malleable Founders' Society, Cleveland.
J. J. Witenhafer, Lake City Malleable Co., Cleveland.

Steel
Ralph R. West, West Steel Castings Co., Cleveland.
J. Trantin, Jr., Youngstown Alloy Casting Corp., Youngstown, Ohio.
C. W. Briggs, Steel Founders' Society of America, Cleveland.

Brass and Bronze
E. F. Hess, Ohio Injector Co., Wadsworth, Ohio.
G. L. Bierly, Mansfield Brass Foundry, Inc., Mansfield, Ohio.

Aluminum and Magnesium
Fred S. Wellman, Wellman Bronze & Aluminum Co., Cleveland.
H. C. Nichols, Quality Castings Co., Orrville, Ohio.
H. J. Rowe, Aluminum Co. of America, Cleveland.

Patterns
J. V. Brost, Brost Pattern & Casting Co., Cleveland.
M. E. Kohler, Scientific Cast Products Corp., Cleveland.
J. S. Parker, Motor Patterns Co., Cleveland.

Pig Iron
T. G. Johnston, Republic Steel Corp., Cleveland.
A. D. Smith, Bethlehem Steel Co., Cleveland.
Wm. Ramsey, Pickands, Mather & Co., Cleveland.

Cupola Operation
W. O. Larson, W. O. Larson Foundry Co., Grafton, Ohio.
Wm. C. Manwell, Fulton Foundry & Machine Co., Cleveland.
Milton Tiley, National Malleable & Steel Castings Co., Cleveland.

Core Production
E. C. Zirzow, National Malleable & Steel Castings Co., Cleveland.
Wm. Kayel.

Philadelphia

Chairman, J. H. S. Spencer,
H. W. Butterworth & Sons Co., Philadelphia.

Quad City

Chairman, P. T. Bancroft,
Republic Coal & Coke Co., Moline, Ill.
A. H. Putnam, A. H. Putnam Co., Rock Island, Ill.
C. F. Burgston, Deere & Co., Moline.
W. E. Jones, Ordnance Steel Foundry, Bettendorf, Iowa.
C. S. Humphrey, C. S. Humphrey Co., Moline.
John Diedrich, Blackhawk Foundry & Machine Co., Davenport, Iowa.

St. Louis

Chairman, C. B. Shanley,
Semi-Steel Casting Co., St. Louis, Mo.
Vice-Chairman, L. V. Kleber,
General Steel Castings Corp.,
Granite City, Ill.
Secretary-Treasurer, John H. Williamson,
M. A. Bell Co., St. Louis.

L. C. Farquhar, American Steel Foundries, East St. Louis, Ill.
W. E. Illig, Banner Iron Works, St. Louis.
A. O. Nilles, Griffin Wheel Co., North Kansas City, Kans.
F. T. O'Hare, Central Brass & Aluminum Foundry, St. Louis.
L. J. Desparois, Pickands Mather & Co., St. Louis.
E. A. Goerger, City Pattern & Model Co., St. Louis.
H. Goodwin, Medart Co., St. Louis.
W. L. Kammerer, Midvale Mining & Mfg. Co., St. Louis.
F. B. Riggan, Key Co., E. St. Louis, Ill.
G. W. Mitsch, American Car & Foundry Co., St. Louis.
Jas. Roland, Fry-Fulton Lumber Co., St. Louis.
W. A. Zeis, Midwest Foundry & Supply Co., Edwardsville, Ill.

Western New York

Chairman, Wm. S. Miller,
Chas. C. Kawin Co., Buffalo, N. Y.

Gray Iron
Alex Rankin, Lake Erie Engineering Corp., Kenmore, N. Y.
M. W. Pohlman, Pohlman Foundry Co., Inc., Buffalo.

Malleable
J. W. Considine, Jewell Alloy & Malleable Co., Inc., Buffalo.
F. J. Wurscher, Acme Steel & Malleable Iron Works, Buffalo.

Steel
J. P. Begley, Pratt & Letchworth Co., Buffalo.
J. H. Sander, American Radiator & Standard Sanitary Corp., Buffalo.

Non-Ferrous
J. C. McCallum, McCallum-Hatch Bronze Co., Buffalo.
H. R. King, Metal & Alloy Specialties Co., Inc., Buffalo.

Wisconsin

Chairman, Wm. J. MacNeill,
Federal Malleable Co., Milwaukee.

Gray Iron
W. F. Bornfleth, Cutler-Hammer, Inc., Milwaukee.
John A. Leisk, Allis-Chalmers Mfg. Co., Milwaukee.
E. L. Roth, Motor Castings Co., W. Allis, Wisconsin.
L. V. Tuttle, Koehring Company, Milwaukee.

Malleable Iron
R. J. Anderson, Belle City Malleable Iron Co., Racine, Wis.
C. A. Gutenkunst, Jr., Milwaukee Malleable & Grey Iron Works, Milwaukee.

Non-Ferrous
Roy M. Jacobs, Standard Brass Works, Milwaukee.
V. C. Mekeel, Ampco Metal, Inc., Milwaukee.

Steel
A. T. Baumer, Wehr Steel Co., Milwaukee.
Carl F. Haertel, Falk Corp., Milwaukee.

(*Photos by Ed. King, Hill & Griffith Co.*)

In addition to electing four new directors at the annual stag outing, held at the Hyde Park Golf and Country Club, members of the Cincinnati District Chapter found time to thoroughly enjoy themselves.

Foundry, Cleveland, in his usual humorous manner. Considerable discussion followed the talk.

Eastern Canada Opens Season at Montreal

By Robt. W. Bartram

SOME 140 members of the Eastern Canada and Newfoundland Chapter gathered at the Mount Royal Hotel, Montreal, September 17, for the Chapter's first meeting of the new season. Chapter Chairman E. N. Delahunt, Warden King Ltd., Montreal, presided and reported that membership of the group now stands at 203, with other new members expected to be enrolled before the October meeting. At present the membership goal of the "baby chapter" of A.F.A. is 250 by the end of this season.

Guest speaker of the evening was Alex Douglas, Peacock Bros., who gave an excellent talk on "Marine Castings." The questionnaire period following the talk was handled in an able manner, giving the chapter an excellent start for the new year.

Statement of Ownership

Statement of the ownership, management, circulation, etc., required by the acts of Congress of August 24, 1912, and March 3, 1933, of *American Foundryman*, American Foundryman's Association, published monthly at Chicago, Ill., for October 1, 1942. State of Illinois, County of Cook, ss. Before me, a notary public in and for the state and county aforesaid, personally appeared R. E. Kennedy, who, having been duly sworn according to law, deposes and says that he is the Editor of the *American Foundryman*, American Foundrymen's Association, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to-wit: 1—That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, American Foundrymen's Association, Inc., Chicago, Ill.; Editor, R. E. Kennedy, Chicago, Ill.; Managing Editor, N. F. Hindle, Chicago, Ill.; Business Managers, None. 2—That the owner is American Foundrymen's Association, Inc., not for profit; stock, none. Principal Officers: L. C. Wilson, President, American Chain & Cable Co., Inc., Reading, Pa.; R. E. Kennedy, Secretary, Chicago, Ill. 3—That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None. 4—That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. R. E. Kennedy, editor. Sworn to and subscribed before me this 20th day of Sept. 1943. (Seal) Jennie Reininga, Notary Public. (My commission expires Feb. 9, 1946.)

A large representation of the Western New York Chapter met at Hotel Buffalo for the group's annual dinner and election of officers, when Frank E. Bates, Worthington Pump & Machinery Corp., Buffalo, was voted new Chapter Chairman.

(*Photos courtesy Jack Heysel, E. J. Woodison Co.*)

Abstracts

NOTE: The following references to articles dealing with the many phases of the foundry industry, have been prepared by the staff of *American Foundryman*, from current technical and trade publications.
When copies of the complete articles are desired, photostat copies may be obtained from the Engineering Societies Library, 29 W. 39th Street, New York, N. Y.

Aluminum Alloys

PLASTIC ADHESIVES. *(See Plastics.)*

RADIOGRAPHIC INSPECTION. *(See Radiography.)*

Forging Dies

SHELL FORGING. (*See Gray Iron.*)

Gray Iron

CHROMIUM-PLATED PISTON RINGS. *"Cylinder and Ring Life with Porous Chromium-Plated Rings,"* Tracy C. Jarrett, *Mechanical Engineering,* vol. 65, No. 9, September, 1943, pp. 633-635. The use of one porous chromium-plated ring in the top groove of aircraft cylinders greatly reduces barrel and ring wear and increases the number of hours between overhauls. The plating surface is first honed to remove traces of turning. Then a definite thickness of chromium is deposited directly on the ring, using a high density current to produce the desired hardness. Then the current is reversed, removing part of the chromium and producing the porous surface. Following plating the rings are subjected to boiling water for one hour to remove traces of hydrogen. The cylinder-contacting surface need not be lapped when a porous-plated top ring is used, for the porous surface permits the ring to carry oil for immediate seating purposes, and to wear and quickly produce its own mating surface. In cylinders operating under sand and dust conditions, the porous plated top ring prevents wear and reduces the amount of abrasive material contacting the lower rings.

FORGING DIES. *"Cast Dies for Forging Shells,"* P. Attenborough, *Metals and Alloys,* vol. 18, No. 2, August, 1943, pp. 287-291. Gray cast iron, chilled iron, so-called "semi-steel," and nickel-molybdenum-chromium alloy irons have been developed as materials for shell forging dies. In the forging process, the billets are heated to the required temperature, descaled and then forged. Cast iron dies may be used for piercing and drawing, upsetting, or piercing and rolling processes. The most widely used type of cast iron die is used for shell nosing. Many factors affect the life of a cast forging die. The grade of material is important, and proper heat treatment may improve its qualities. Correct foundry practice is essential for producing sound, heavy sections. Early failure may result from improper fitting of the die to the bolster. As the size of shell made increases, service conditions become more severe. Also, as the degree of deformation increases, die life is lowered. Shells should be properly preheated before forging. Treatment received by the die such as water spray cooling, dressing, frequency of use, and water cooling have considerable effect upon die life. Die design and thickness also influence die life, but these are beyond the control of the foundry. The cast iron referred to by the author is Meehanite. Data on performance of dies, and weights and dimensions of shell billets and forgings are presented in tabular form.

IMPACT TESTING. *"Recommended Procedure for the Impact Test for Cast Iron," Foundry Trade Journal,* vol. 70, No. 1405, July 22, 1943, pp. 239, 246. A study of impact testing methods applicable to gray cast iron has resulted in the recommendation of a method as a possible standard by the Sub-Committee of the Technical Advisory Panel to the Directors for Iron Castings of the Ministry of Supply. The test which they recommend can be performed on a standard 120 ft.-lb. Izod impact machine. The test piece should be a 0.798-in. diam. plain bar with no notch or groove. A separate test piece should be used for each test. The method of gripping the test piece is illustrated in the article. A striking height of 22 mm. measured from the top of the rear grip is to be employed. Care should be taken to see that the grips fit well in the machine and that the test pieces fit well in the grips. Test pieces may be machined from the 1.2-in. diam. by 21 in. long transverse bar. The top end of vertically cast bars should not be used.

INGOT MOLDS. *"A Review of the Work of the Inot Molds Sub-Committee,"* R. H. Myers, *Paper No.* 19, 1943, *of the Committee on the Heterogeneity of Steel Ingots, The Iron and Steel Institute Advance Copy,* March, 1943, 24 pp. As the result of experimental work and of statistical studies, it is clearly shown that great economy in ingot-mold material can be obtained very simply by reduced casting-to-stripping time, by attention to wall thickness and composition, and by improved layout, equipment and practice in the casting pit.

Impact Testing

GRAY IRON. (*See Gray Iron.*)

Inclusions

SULPHIDE INCLUSIONS. (*See Metallography.*)

Ingot Molds

MATERIAL ECONOMY. (*See Gray Iron.*)

Inspection

FLUORESCENT INDICATORS. *"Crack Detection," The Metal Industry,* vol. 62, No. 23, June 4, 1943, p. 363. Ready detection of cracks in non-ferrous parts is made possible by the use of fluorescent materials and ultra violet radiation. The parts to be inspected, contained in a basket, are dipped into a solution of a fluorescent material at a temperature at which the fluorescent material will vaporize from the surface. After a short time, the articles are removed from the solution and excess fluorescent material vaporizes. The fluorescent material remaining in cracks will then be easily seen when the part is exposed to ultra violet radiation.

RADIOGRAPHIC. *(See Radiography.)*

Magnesium Alloys

PLASTIC ADHESIVES. *(See Plastics.)*

RADIOGRAPHIC INSPECTION. *(See Radiography.)*

Malleable Iron

ORDNANCE CASTINGS. *"Malleable Iron Castings in Ordnance,"* Lt. Col. J. H. Frye, *Steel,* vol. 113, No. 8, August 23, 1943, pp. 94-96, 126-127. The author describes the numerous uses of malleable and pearlitic malleable iron castings to replace parts formerly made of other metals or made by other processes.

Management

FOUNDRY STATISTSCS. *"United States Has 4802 Foundries," The Foundry,* vol. 71, No. 7, July, 1943, pp. 93-131. This article reports the number of foundries of various kinds in the United States and Canada, as compiled from statistics taken from *Penton's Foundry List,* 1943-1944 edition. The article also includes a table showing the distribution of foundries in the states and provinces of United States and Canada in 1941 and 1943.

Metallography

POLISHING. *"A Versatile Metallographic Polishing Process,"* Mildred Ferguson, *Metal Progress,* vol. 43, No. 5, pp. 743-744. Use of a paraffin disc is an essential part of polishing specimens at the Westinghouse Research Laboratories. The order of their polishing procedure is (1)

Rough grinding to a flat surface on the A.S.M. metallographic grinder; (2) No. 100 carborundum in 1:1 liquid soap solution on a paraffin disc; (3) No. 600 aloxite in 1:1 soap solution on paraffin; (4) No. 3 Fisher levigated alumina in distilled water on a "selvyt" cloth base; (5) Magnesium oxide, "shamva," on "selvyt" or white kitten's-ear broadcloth. The use of paraffin discs minimizes polishing pits, maintains sharper corners, retains inclusions, and reduces polishing time. The polishing procedure as given above is used not only for metals and alloys, but also for carbon brushes and glass-metal seals.

SULPHIDE INCLUSIONS. *"Sulphides in Nickel and Nickel Alloys,"* A. M. Hall, American Institute of Mining and Metallurgical Engineers Technical Publication No. 1584, *Metals Technology,* vol. 10, No. 4, June, 1943, 7 pages. Sulphide inclusions which may occur in malleable nickel, Monel, and Inconel are described as they occurred in ingots produced from small induction-furnace melts. Means were developed for distinguishing between the various forms of sulphides. Most of these methods are also applicable to identifying sulphides formed upon diffusion of sulphur into the solid metal.

Molding Sand

STEEL MOLDING SAND. *"British Resources of Steel Molding Sands,"* W. Davies and W. J. Rees, Advance Copy, *Paper No. 4, 1943, Steel Castings Research Committee, The Iron and Steel Institute.* In this paper the authors have presented the results of an investigation of the grits and sandstones available in England. Attention is directed to the relationship between the petrology and the molding characteristics of grits, and it is shown that from a petrological examination to determine the mineralogical composition (by micrometric analysis) and the microstructure, useful indications can be obtained of the form of the mechanical-grading curve, the green strength and permeability, and the refractoriness. The important petrological features of the type of grit likely to be suitable for steel-molding purposes are: (a) The grain size should be uniform; (b) Suturing in the quartzitic aggregates should be simple, so that the proportion of composite grains in the crushed material will be small; it also appears to be desirable that the quartz grains should be free from strain; (c) The quartz content should be not less than 80 per cent; (d) The content of sericite and kaolin should not be high, because of their effect in increasing sinterability; the presence of some limonite is advantageous, but its proportion should not be high; a feldspar content as high as 10 per cent may not be detrimental if it is fresh, although a high feldspar content reduces the ultimate refractoriness of the crushed grit. Certain of the crushed grits have characteristics similar to those of synthetic molding materials, based on high-silica sands, at present used in steel foundries. Part I of the paper describes the upper carboniferous grits and sandstones of the eastern part of the Peak District; Part II describes the lower carboniferous sandstones of Rothbury Forest and Alnwick Moor, Northumberland; Part III describes the Moor Grit of Northeast Yorkshire; Part IV describes the rotten-rock molding sands about Wolsingham, Co. Durham; and Part V describes the Permian yellow sands of Durham and Yorkshire.

Nickel Alloys

SULPHIDE INCLUSIONS. *(See Metallography.)*

Non-Destructive Testing

FLUORESCENT INDICATORS. *(See Inspection.)*

Piston Rings

CHROMIUM PLATED. *(See Gray Iron.)*

Plastics

ADHESIVES. *"Joining Light Alloys by Plastic Adhesives," The Iron Age,* vol. 152, No. 8, August 19, 1943, pp. 52-53. Strong joints between light metals and light metals, steel and steel, or metal and wood are made by applying resin-bonding by a controlled method adapted to the nature of the surfaces to be joined and the type of structure to be assembled. The bond is slightly thermoplastic, and loses some strength above 212°F. However, aircraft construction offers many opportunities for uses below this temperature. Materials are cemented together without stress concentrations, to give aerodynamically smooth joints which are gasoline tight and often stronger than riveted joints.

Protective Coatings

BLACK FINISHES. *(See Steel.)*

Radiography

LIGHT ALLOY CASTINGS. *"Radiographic Inspection of Light Alloy Castings in the Aircraft Industry,"* Robert Taylor, *Industrial Radiography,* Summer, 1943, pp. 19-22. X-ray inspection is desirable for all aircraft castings which present any constitutional uncertainty. Casting defects which can be shown on radiographs are cracks, shrinkage cavities, cold shuts, misruns, porosity, micro-shrinkage, blowholes, dross, sand inclusions, and segregations. In order to show up and interpret these defects consistently and well, care should be given to several factors in radiographic technique. The film used should be the type most suitable for the desired purpose. Penetrameters should be used to indicate the penetrameter sensitivity obtained. The film blackening or density should be controlled and scattering should be eliminated insofar as possible. Exposures for different thicknesses of metal can be determined with the aid of a step-ladder wedge. When the correct exposure for each thickness has been found, a chart may be prepared. Thereafter exposures for various thicknesses can be read from the chart. The use of radiographic inspection of aircraft castings serves two purposes: it enables the inspector to reject defective castings, and it assists the foundryman in perfecting his practice.

Safety

SLINGS. *"Safe Sling Practice,"* J. M. Garris, *Occupational Hazards,* vol. 5, No. 10, August, 1943, pp. 12-13, 36. Safe use of slings starts with the selection of dependable materials. Slings are generally made of one of three materials—manilla rope, chain, or wire rope. A three-strand construction Manilla rope is the best kind of rope where strength and durability are requirements. Wrought iron chain welds readily, has a fibrous nature, and generally gives warning before failure. Wire rope produces strong, dependable slings which are used for lifting heavy loads. A generous factor of safety should be allowed on all slings. Safety factors from 2.5 to 7 have been in use.

CLIP FASTENINGS. *"Approved 'Clipping,'"* F. L. Spangler, *Steel,* vol. 112, No. 25, June 21, 1943, p. 100. The author describes the right and wrong ways to make clip fastenings on wire rope, and illustrates both ways with drawings and photographs.

Safety and Hygiene

WOMEN WORKERS. *"Check List for the Woman Worker,"* E. W. Bullard, *Occupational Hazards,* vol. 5, No. 8, June, 1943, pp. 14-16. Certain factors demand study and consideration when women are employed for industrial work. Special attention should be given to lifting. Women should not lift weights in excess of 25 pounds, and they should be instructed how to lift properly. Good lighting should be provided, especially when women are doing work of a very fine nature. General sanitation and safety throughout the plant are essential. Only safe clothing should be worn. Frills, loose-fitting garments, and other types of clothing hazards should be avoided. Workers should be provided with the proper footwear, hand protection, eye protection, respiratory protection, and head and hair protection. The use of gloves around moving machinery should be forbidden. Eye protection demands good, light weight goggles or eye shields with visors. Women are thought to be highly susceptible to fumes of benzene, T.N.T., carbon disulphide, lead, mercury, arsenic, and silica dust. Hair should be protected with caps or nets.

Scrap Salvage

BRIQUETTING. *"Iron and Steel Briquettes Aid Salvage,"* A. W. Wood, *Iron and Steel,* vol. 16, No. 12, July, 1943, p. 467. Briquetting of loose turnings of steel and cast iron of segregated analyses provides an additional source of scrap of known composition, as well as increasing the scrap value of the turnings. The briquetting installation in use in the author's plant consists of a crusher to reduce the size of steel turnings (cast iron turnings are already of desired size for briquetting); a blower system to carry the crushed scrap into an overhead hopper; a hydraulic briquetting machine; and a conveyor to remove briquettes. With a force of 2,300 psi., chips are compressed into a briquette of 2¼ in. diameter and 1 to 3½ in. length. Steel scrap of an analysis not suitable for remelting is briquetted for ease of handling and economy.

Steel

ARMAMENT CASTINGS. *"American Steel Foundries Casts Armor for Tanks,"* Frank G. Steinebach, *The Foundry,* vol. 71, No. 7, July, 1943, pp. 78-82, 172-176. The author gives a general description of the construction, layout, and operation of a foundry which was completed in record time for the production of cast steel for armament.

MOLDING SAND. *(See Molding Sand.)*

PLASTIC ADHESIVES. *(See Plastics.)*

CENTRIFUGAL CASTING. *"Centrifugally-Cast Steel,"* C. K. Donoho, *Foundry Trade Journal,* vol. 70, No. 1401, June 24, 1943, pp. 155-159, 154. Paper presented at meeting of Steel Founders' Society of America, Chicago, Feb. 10, 1943. Centrifugal casting is pressure casting in which the pressure is supplied by centrifugal force. Therefore, the pressure not only tends to eliminate gases and reduce shrinkage, but it has a selective action which throws heavier components toward the outside of the casting. Centrifugal castings may be spun about either a horizontal or vertical axis. Castings spun about a horizontal axis have central openings perfectly cylindrical shaped. Castings spun about a vertical or inclined axis have parabaloid central openings, the contour of which depends upon spinning speed, maximum diameter of top of the cavity, and the angle of inclination of the axis. Pipe is generally spun about a vertical axis. Disc-shaped castings and wheels are generally spun about a vertical axis. Castings may also be produced by spinning clusters of castings about a central sprue. Centrifugal casting produces a high yield of sound, dense, clean castings, eliminates the need for cores, and simplifies inspection. However, size and shape of castings limit the process somewhat, and installation and maintenance of the equipment is expensive. Generally speaking, large numbers of castings must be required to make the centrifugal process economically feasible. Spinning speeds vary with the size and type of casting, and the mold material. Sand-lined molds are generally spun at speeds which will produce a force of about 75 times gravity. Metal molds may be spun at somewhat lower speeds because of the chilling effect of the mold surface. Following this description of centrifugal casting methods, the author discusses the melting plant used, types of castings produced, and physical properties of castings produced by the American Cast Iron Pipe Co.

PROTECTIVE COATINGS. *"Black Finishes on Steel,"* A. C. West, *Canadian Metals and Metallurgical Industries,* vol. 6, No. 6, June, 1943, pp. 32-33. Black finishes are given to steel articles to improve their appearance, to increase their resistance to rusting, to give them a non-reflecting surface, or to supply a suitable base for paint. Black finishes for steel are of three types: black oxide films, phosphate coatings, and zinc plating followed by blackening. Black oxide finishes are applied by cleaning and pickling the steel, immersing it in a highly alkaline bath at about 290° F., and removing after about ten minutes. The resultant film of Fe_3O_4 is little protection by itself, and should be followed by a coating of oil or lacquer. The finish is of little value for outdoor use. Its appearance, however, is very good. Phosphate coatings are applied by immersing the cleaned article in a phosphating bath of 180-210° F. The resulting film is metallic phosphate insoluble in water. Further treatment with a dilute chromate solution will increase the corrosion resistance. This film is very absorptive and makes an excellent paint base. It has little value in preventing corrosion unless it is covered with oil or lacquer. Zinc plating followed by blackening by immersing in a proprietary bath produces a beautiful jet black finish. Its rustproofing value is high. Chemicals used in producing black oxide and phosphate coatings are easily available. However, the zinc for the zinc blackening process is available only for defense production.

Testing

IMPACT TESTS. *(See Gray Iron.)*
NON-DESTRUCTIVE. *(See Inspection.)*

X-ray

INSPECTION. *(See Radiography.)*

Schedule of October Chapter Meetings

October 1
Western New York
Touraine Hotel, Buffalo
FRED G. SEFING
International Nickel Co.
"A Study of Molding Methods for Sound Castings"

October 4
Central Indiana
Washington Hotel, Indianapolis
DR. JAMES T. MACKINZIE
American Cast Iron Pipe Co.
"Cupola Operations"

Chicago
Chicago Bar Assn., Chicago
H. W. DIETERT
Harry W. Dietert Co.
"Foundry Sand Control"

Metropolitan
Essex House, Newark, N. J.
ROUND TABLE MEETINGS
Gray Iron, Steel, Magnesium, Aluminum, Copper-Base Alloy
"Gating and Risering"

October 5
Michiana
Whitcome Hotel, St. Joseph, Mich.
M. D. JOHNSON
Caterpillar Tractor Co.
"Quality Control"

October 8
Central New York
Cornell University, Ithaca, N. Y.
PROF. J. R. MOYNIHAN
Sibley College, Cornell University
LABORATORY DEMONSTRATION

Northern California
Orinda Country Club
GOLF OUTING

Philadelphia
Engineer's Club, Philadelphia
D. BASCH
General Electric Co.
"Future of Magnesium"

Southern California
Clark Hotel, Los Angeles

October 11
Cincinnati
Cincinnati Club, Cincinnati
JAMES A. MURPHY
Jas. A. Murphy & Co.
"Compressed Air—Its Troubles and Remedies"

Western Michigan
Ferry Hotel, Grand Haven, Mich.
GEORGE P. HALLIWELL
H. Kramer & Co.
"War Trends in Brasses and Bronzes"

October 13
New England Foundrymen's Assn.
Engineer's Club, Boston

October 14
Detroit
Horace H. Rackman Memorial
ROUND TARLE MEETINGS
Aluminum, Gray Iron, Steel, Malleable

Northeastern Ohio
Cleveland Club, Cleveland
L. W. KEMPF
Aluminum Co. of America
"Postwar Aluminum Castings"

October 15
Eastern Canada and Newfoundland
Mount Royal Hotel, Montreal
QUIZ NIGHT

October 18
Quad City
Fort Armstrong Hotel, Rock Island, Ill.
B. P. MULCAHY
Citizens Gas & Coke Utility
"Foundry Coke"

October 22
Chesapeake
Engineer's Club, Baltimore, Md.
J. S. VANICK
International Nickel Co.
"Heat Treatment of Cast Iron"

October 26
Toledo
Hillcrest Hotel
STEEL NIGHT

October 29
Ontario
Royal York Hotel, Toronto
ROUND TABLE MEETINGS
Gray Iron, Malleable, Non-Ferrous
"Gates and Risers"

November Meetings

November 1
Chicago
Chicago Bar Assn., Chicago
ROUND TABLE MEETINGS
Gray Iron
"Heat Treatment of Castings"
Steel
"Acid Electric Steel"
Non-Ferrous
"Rigging Patterns for Production"

Metropolitan
Essex House, Newark, N. J.
NATIONAL OFFICERS' NIGHT

November 2
Michiana
Hotel LaSalle, South Bend, Ind.